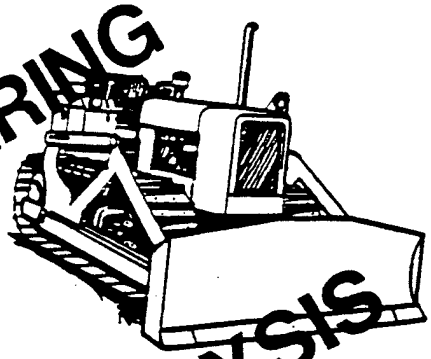
ENERGY ENGINEERING ANALYSIS



EMCS
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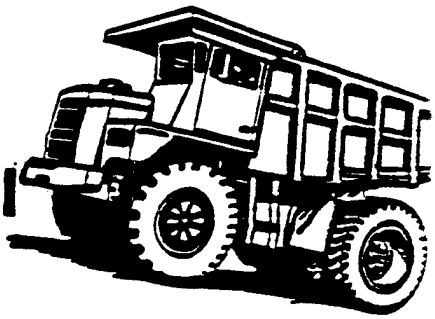
FINAL REPORT

15 JULY 1982



FORT LEONARD WOOD, MISSOURI

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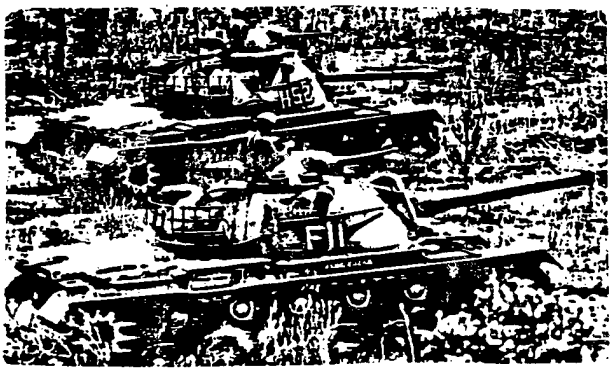

Contract No. DACA45-80-C-0143
administered by:

DEPARTMENT OF THE ARMY
DISTRICT CORPS OF ENGINEERS
6014 US P.O. OFFICE COURTHOUSE
OMAHA, NEBRASKA 68102

VOLUME 1A EXECUTIVE SUMMARY

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
P.O. BOX 9005
CHAMPAIGN, ILLINOIS 61826-9005

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15 July 1982

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District Corps of Engineers
6014 U.S. Post Office and Courthouse
Omaha, Nebraska

Attn: Mr. Charles Pribyl

Re: DACA 45-80-C-0143
File: 15195(1)

Forwarded for your review and comment is the final submittal for the Fort Leonard Wood/Fort Benjamin Harrison Energy Engineering Analysis for the above referenced contract.

Very truly yours,

ENGINEERING DESIGN & MANAGEMENT, INC.

James L. Clowers, P.E.
Vice President

JLC:ge

STUDY OUTLINE

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1.3	Completed ECIP Effectiveness
1.3.1	Barracks - Ventilation
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ECIPS

EMCS (ECIP)
Alter Barracks Ventilation (ECIP)
Alter Dining Halls (ECIP)
Alter Central Heating Plants (ECIP)
Alter Specker Complex Windows (ECIP)
Windows, Siding and Insulation (ECIP)

INCREMENT G

Install Flow Restrictors (MFH)
Install Flow Restrictors (Bachelor Housing)
Mechanical Alterations, Various Facilities
Add HWH Insulation (MFH)
Install Heat Reclaim System

VOLUME 1A EXECUTIVE SUMMARY

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VOLUME 1A - EXECUTIVE SUMMARY

1.0 GENERAL DISCUSSION

1.0 General Discussion

Throughout the course of this study, it became evident that not only was Fort Leonard Wood failing to achieve projected savings for ECIPs accomplished to date, but the basewide energy consumption was increasing above that established by the FY75 base year. As a consequence of this increased consumption, the calculated ECIP energy savings to FY85 falls short of the 25% Army Facilities Energy goal. This increase in consumption has occurred primarily from FY80 to FY81 (see Figure 3.2.1-A). The following discussion will enumerate several explanations for the recent increases in energy consumption as well as the failure to meet projected ECIP goals to date.

It should be noted that if the sharp increase betwen FY80 - FY81 is only a temporary trend, the base may meet TRADOC's FY85 goals through ECIP, maintenance, repair, and energy management actions proposed in this study.

1.1 Energy Management: The success of any energy conservation program depends on the cooperation and assistance of the personnel and dependents at the installation. In this regard, Fort Leonard Wood's Facilities Engineering personnel have encountered resistence from the base population when new controls are installed or policies and energy conservation measures have been implemented. Moreover, in the past, lack of emphasis in and support for energy conservation by management have limited the success of the FE efforts to reduce basewide energy consumption.

Implementation of the energy conservation measures recommended in this study will result in reduced consumption only if implemented as specified, and a concerted effort is made by individuals to cooperate with these modifications.

1.2 Electrical Consumption: Whereas basewide fuel consumption per year has decreased since FY79, electrical consumption has increased. Likewise, electrical demand has increased every fiscal year since FY75. The FY81 peak KW demand was 28,400 KW, indicating a 24% increase above the FY75 level.

The sharp increase in annual energy consumption between FY80 and FY81 is partially attributable to the increased square footage of air-conditioned space on the base, namely in the family housing areas.

At the present time, all housing quarters have either received or are programmed to receive central air-conditioning systems.

Through energy conservation measures, annual electrical consumption should decline on a kilowatt per square foot basis. In addition, electrical costs savings could be reduced through demand limiting in conjunction with RF and EMCS controls (see Volume 1, Section 8).

1.3 Completed ECIP Effectiveness:

1.3.1 One of the early ECIP projects replaced windows in the barracks area with insulated, double pane glass and reduced the window area with insulated panels. The energy savings envisioned as a result of that change

have never been realized because the windows must be open 1-1/2 inches to provide outside air. This is in response to the Fort Leonard Wood Supplement to Army Regulation 40-5, Paragraph 5-17d, which requires 600 to 900 cubic feet per hour per person fresh air supply, or in non-mechanically ventilated barracks, windows to be kept partially open. We have studied the barracks in question and have included a proposed modification as an ECIP package (Project #200). We should point out that the barracks in the 1000 area already have the capability of providing the minimum outside air requirements. Care should be taken to ensure that the regulation is not enforced across the board without regard to the systems involved.

1.3.2 The windows installed in the officer housing area under Fort Leonard Wood local procurement contract 76-C-0227 have never worked satisfactorily. The window unit itself seems to have met specifications marginally at the time of testing, but improper installation allows air to infiltrate around the window's perimeter. Occupants state that enough air comes in during the winter to push the curtain away from the window. The Facility Engineering contract file indicates that the infiltration rates were questioned from the outset. There was excessive testing — many units failed three or more times before finally passing. Apparently the conflict was resolved when the government accepted the marginal installation because of specification deficiencies. Most of the problem could be corrected by preventive maintenance crews utilizing caulking guns or a foam sealant as they make their periodic visit to the house. It is recommended that an in-house program be initiated immediately to correct the problem.

1.3.3 Many of the windows currently being installed under Corps of Engineers Contract No. DACA 45-80C-0069 have the same problem outlined in 1.3.2 (3.1.2) above. If everything is just right and the contractor does not have to do anything extra to make it fit, the window installation is good and tight. If anything extra must be done, the specifications do not require it, and the windows permit infiltration around the perimeter.

The problem varies from building to building and from window to window within the building. Once again, the corrective action is best accomplished by in-house preventive maintenance crews and should be started immediately.

1.3.4 Many of the past energy conservation measures were performed on buildings which are currently unoccupied and winterized, or are used for storage. Since little or no energy goes into the buildings, little or none is saved by the investment. At the same time, many buildings which are fully occupied and in constant use have had no energy work done on them. The primary reasons for this situation are changes in building utilization since the programming action, and options in ECIP projects which dropped out due to lack of funds. The changes in space utilization will require a long range space utilization study by Ft. Leonard Wood personnel to maximize the use of those facilities which have been improved, and minimize the full time use of those which have not. Mass moves are not practical, but each time a move must be made, consideration should be given to this problem.

1.4 Operating hours for Building 1609, Daugherty Bowling Center: The operating hours for this facility should be evaluated for a possible

reduction. Our observation is that on weekdays prior to 1700, there is minimal activity. There is some increase in occupancy at lunch time, but nothing which could not be absorbed by the Crawford Bowling Center. After 1700, the activity picks up with individual and league play. Due to the trainee load, the facility is used to the maximum from about 1700 Friday through the weekend; therefore, feel it could be operated profitably around-the-clock during this time period.

If careful attention is given to humidity control to avoid damage to the lanes, considerable energy could be saved by adjusting the hours of operation in this facility and setting back the HVAC accordingly.

1.5 Replacement/Conversion of Oversized Oil Boilers and Furnaces: Many of the boilers and furnaces installed in the buildings on Fort Leonard Wood are original equipment which were sized to handle a heating load for a totally uninsulated, energy inefficient building. As a result of the ECIP activity, these heating loads have been reduced considerably. Review of the ASHRAE part load efficiency analysis shows that the efficiency of an oversized furnace can fall off by as much as 50 percent due to the constant start/stop losses up the stack. A furnace or boiler is most efficient in a steady state operation, and anything less than that results in losses. What can happen is that much of the energy which was previously going out through the building envelope is now being lost up the stack of furnaces or boilers now that these transmission losses have been reduced!

We had commenced in the development of an ECIP package for replacing a large number of furnaces and boilers when a copy of the DAEN-MPD-U letter (subject: Energy Conservation Investment Program (ECIP) - Justification Data, 4 November 81) was forwarded to us on 10 December 1981. Paragaph 3.d of that letter reads as follows:

> d. Claims for boiler efficiency improvements must identify data to support present properly adjusted boiler operation and future expected efficiency. If full replacement of boilers is indicated, explain rejection of alternatives such as replace burners, nonfunctioning controls, etc. Assessment of complete existing installation is required to make accurate determinations of required retrofit actions.

Detailed information regarding controls and operating condition of existing equipment is beyond this contract's scope of work. Although we have had an excellent correlation between actual fuel oil deliveries and our ASHRAE-based calculations, we cannot meet the requirements of the DAEN-MPD-U letter with this package. Therefore, we have included the building lists and all the backup computer runs in the backup data (Volume 3, Appendix 2 (Reference Data) - Part 6) for the Facility Engineer to use in developing a program for boiler and furnace replacement.

In all replacements, close attention should be given to proper sizing at approximately 120% of the present boiler load, rather than replacing existing equipment on a BTU for BTU basis.

In addition, careful consideration should be given to a conversion from No. 2 oil to propane should take place each time a boiler or furnace is

replaced. The $3.75 per MBTU difference in price will quickly generate financing for other investment projects.

1.6 Interior Insulation of Masonry Walls: We were requested to investigate the feasibility of insulating existing masonry walls. First, we looked at a theoretical wall with windows and no perimeter heating as the most simple, least expensive application. The treatment consists of 1" of styrofoam insulation applied directly to the masonry with 1" steel furring strips covered with 1/2" drywall which is taped, floated and painted. The estimated cost is $3.06/sq. ft. installed. The treatment lowers the U value from 0.29 to 0.126; Delta U = 0.164. Estimated savings per square foot for buildings on central plant steam are as follows:

$$\text{Savings} = \frac{1 \text{ SF} \times 0.164 \times 4570 \text{ degree days} \times 24 \text{ hours}}{0.8 \times 10^6} \times 0.71 \times 1.56$$

$$= .0249 \text{ MBTU/year/SF}$$

No. 6 Oil

.0249 x $6.01/MBTU = $0.15/year

Total Benefit = 0.15 x 20.05 = $3.00

B/C = 3.00/3.06 = 0.98 (Marginal)

We quit at that point, because adding the complication of a perimeter heating/cooling system to be removed and reinstalled or fitted around the insulation would only reduce the B/C ratio.

1.7 Electronic Ignition and Automatic Stack Dampers on Furnaces And Boilers: The economic feasibility of retrofitting existing furnaces and boilers to these energy saving features is closely related to the age of the equipment. The limititation of this study to typical buildings did not permit proper evaluation of all equipment. The following analysis and guidelines are presented for the Facility Engineer's use in evaluating equipment for retrofit. The age guidelines are based upon the general economic life of 15 years and should be modified to first hand knowledge of actual conditions.

1.7.1 Electronic Ignition On Propane Furnaces and Boilers

The average standing pilot in a residential gas furnace burns 1 - 2 cubic feet of gas per hour. For this analysis, 1.5 CFH will be used.

1.5 CFH x 24 hr/day x 365 days/yr = 13,400 CF/Yr

13,400 x 2.52 MBTU/1000 CF = 33.1 MBTU

33.1 MBTU x $6.20 = $205/Year

Estimated cost of electric ignition conversion installed is $150.

For ECIP Economic Analysis:

CWE = $150 x $(1.05)^2$ = $165
Design = 150 x 1.06 = $175

$205/yr x 13.112 = $2691

B/C = 2691/175 = 15.4

E/C = 33.1/165 = 200.6

Payback = $165/$205 = 0.8

Any propane furnace or boiler which is not programmed for replacement within the next year should be retrofitted with electronic ignition and automatic stack dampers.

1.7.2 Automatic Stack Dampers on Furnaces and Boilers

Manufacturers project 12% savings for automatic stack dampers. For this analysis 10% will be used.

A typical furnace or boiler will be assumed to be 150,000 BTUH. Assuming that it is properly sized, the estimated annual consumption becomes:

$$\frac{0.150 \times 4570 \times 24}{59 \times 0.8 \text{ eff}} \times 0.71 \times 1.56 = 386 \text{ MBTU/year}$$

386 x 10% = 38.6 MBTU saved

Estimated cost of automatic stack dampers installed is $150.

For ECIP Economic Analysis:

CWE = $150 x $(1.05)^2$ = $165
Design = $165 x 1.06 = $175

38.6 x $6.20 = $239/year
$239 x 13.112 = $3138 benefit

B/C = 3138/175 = 17.9

E/C = 38.6/0.165 = 233.9
Payback = $165/$239 = .7 years

Any furnace or boiler with electronic ignition which does not presently have an automatic stack damper should have one installed. Any new installation should have both features.

1.8 Space Utilization: In this regard, there appears to be a low density in many buildings around the post. It is recommended that a concerted effort be made to consolidate functions into a more reasonable area and shutdown and winterize as many buildings as possible. At the present, each unit makes its own decisions regarding the space assigned to them and submit their own work orders for winterization. They do not tend to make

it difficult on themselves. The Energy Management Branch should be involved in evaluating efficient space utilization, estimating energy costs for space maintenance, and recommending which buildings should be shutdown. Significant energy savings could be realized in this manner.

1.9 Maintenance. ECIP projects completed in response to previous studies have brought many Fort Leonard Wood facilities to recommended standards of insulation, window area and type, and weatherstripping. However, many facilities continue using as much energy as before because of hot water, chilled water or steam leaks, weatherstripping deteriorated or damaged since installation, or malfunctioning controls. Maintenance of systems and facilities has been one of the most serious energy conservation problems at Fort Leonard Wood. No amount of ECIP work will actually result in energy savings if it is allowed to deteriorate, or if the energy is lost before the ECO has the opportunity to save it. The importance of this problem was discussed with the new Facilities Engineer along with a tour of the facilitites to demonstrate how widespread it is. Since then, a concerted effort has been underway to repair leaks and replace damaged insulation.

As an example, the energy lost in a one gallon per minute leak is as follows:

Hot Water:

Some of the leaks were 140 degree domestic hot water and some were 180 degree heating system water, so 160 degrees will be used. Many were in the 360 degree High Temperature Hot Water (HTHW) system. Cold water temperature will be assumed to be 60 degrees.

Boiler efficiency, assume 0.75.

$$\frac{1 \text{ gpm } (8.34 \text{ lb/gal}) \ (160-60) \text{ degrees } (1 \text{ BTU/lb/degree})}{.75}$$

= 1112 BTU/min.
= 66720 BTUH
= 584.5 MBTU per year. (No. 6 oil, $3515; LPG, $3625; No. 2 Oil, $5815)

For HTHW multiply by 3.0 = 1753.5 MBTU per year

Steam:

1 GPM water as steam

Steam at 212 degrees, atmospheric pressure = 7150 BTU/Lb

1150.4 BTU/Lb (8.34 lb/gal) (1 gal/min) =

= 9594.3 BTU/Min
= 575,658 BTUH
= 13.8 MBTU/day
= 5037 MBTU per year (No. 6 Oil, $30,270; LPG, $31,230; No. 2 Oil, $50,120)

A general observation, which can be made concerning maintenance personnel the world over, is that most do not really understand energy conservation and the relative importance of each element of the building system. They do not understand concepts like infiltration and what it costs in energy. We find the personnel at Fort Leonard Wood to be no exception to this general statement. Therefore, we recommend a short energy conservation awareness training session for maintenance personnel at the working level. Use a simple heating and cooling load calculation to show the difference in percent of energy used for properly functioning building systems and those which have deteriorated. Show what hot or chilled water or steam leaks cost in terms of total building energy consumption. Show why doors and windows should fit tightly, why worn out weatherstripping should be replaced, and cracks and holes caulked. We think personnel who are aware of the significance of the problem are more apt to correct it when they see it.

2.0 ENERGY PLAN

2.0 Energy Plan

The following section enumerates feasible energy measures which have been accomplished to date and those proposed as future ECIP and Increment G projects.

The ECIPs which have been accomplished to date consist primarily of architectural modifications to buildings and family housing quarters. For example, double-glazed windows, storm windows, insulation, weatherstripping, and caulking have been programmed or completed for the majority of active buildings on base. However, as noted in Section 1, the effectiveness of several of these ECIPs, due to specification or installation problems, is questionable. Yet, the declining fuel consumption (MBTU/KSF/Degree Day/Year) between FY76 and FY80, noninclusive, indicates that these ECIPs have been somewhat effective during this period of time in reducing consumption (see Figure 3.2, p 3-4 of this Executive Summary Volume). In addition, the energy related maintenance and BMAR projects accomplished by the FE, such as lighting reduction, provide contributions to energy conservation. Section 2.2.1 provides 1391, 1391c, and an Economic Analysis Summary for each ECIP proposed, and Section 2.2.2 presents feasible Increment G projects. The following paragraphs briefly describe these proposed ECIP and Increment G projects.

ECIPS

A. At the present time, barracks in the 600, 700, and 800 areas receive no mechanical ventilation. Due to this condition and the AR40-5 policy to prevent respiratory infections, the windows must remain open 1-1/2" to provide outside air. As a result, the window replacement ECIP for these barracks has not resulted in reduced energy consumption. The amount of air entering through a 1-1/2" opening exceeds infiltration heat losses through a closed, single-glazed window. This proposed ECIP project will reduce infiltration losses through the installation of mechanical ventilation, thereby providing the potential for reduced energy consumption as calculated for these barracks under the window replacement ECIPs (Phase I and II).

B. Modifications to the exhaust systems of dining halls in the 600, 700, 800, 1000, and 1700 areas are essential to reduce energy requirements for conditioned make-up air. The existing exhaust hoods in the 600, 700, 8000, and 1000 areas remove conditioned air from the space, requiring conditioned make-up air to replace this exhausted air. Through the use of outside air, the need for conditioned make-up air will be eliminated.

   In addition, the 1740 and 1750 dining halls are currently utilizing one large exhaust fan per hall, even during periods of low occupancy (i.e. winter). Through the installation of two small fans, one-half of the serving line can be shutdown during these low occupancy periods, resulting in reduced energy requirements.

C. The central plants are currently rejecting waste heat into the atmosphere through the stack or into the sewer through a blowdown

system. The installation of stack gas economizers in the five central plans (645, 745, 1021, and 2369) and blowdown heat recovery systems in three of these plants (311, 645, 745) will provide significant energy savings.

D. Two alternative energy monitoring and control system (EMCS) proposals are presented for Fort Leonard Wood: Alternative 1 would integrate and upgrade the existing automation and surveillance system central control room from the existing Johnson JC80/45 to a JC80/55. An entirely new data transmission media (DTM) would be installed, and existing buildings would have energy conserving points added. The JC80/55 would meet the CEGS 13947 specification with the exception of the fortran compiler requirement.

Alternate 2 differs only with regard to the central control room equipment; completely new central room equipment would be installed to meet the CEGS 13949 specification. Due to the additional costs required in Alternative 2, Alternative 1 is recommended, and an ECIP package has been prepared. As a result of this energy conservation project, Fort Leonard Wood will realize substantial energy savings per year.

E. Although the majority of the facilities at Fort Leonard Wood have been programmed for architectural modifications, to reduce basewide energy consumption, several of the remaining buildings require retrofit projects. Therefore, an ECIP package has been proposed to upgrade these buildings through the installation of wall, ceiling and floor insulation, skirting, window and door replacement, and reduction of excess window area.

F. When the Specker Complex was constructed in 1978, single glazed windows were specified, resulting in higher energy requirements for these barracks. The existing windows can be modified to double glazed units without total window replacement, and this modification will lead to reduced energy consumption.

INCREMENT G

A. Flow restrictors for all military family housing (MFH) units are recommended to reduce energy consumption resulting from hot water usage.

B. Flow restrictors are also proposed for all shower heads in bachelor housing facilities, resulting in an estimated payback period of less than one year.

C. An Increment G project has been developed for mechanical alterations to various facilities. These modifications include the installation of enthalpy control economizer systems in Buildings 310, 1608, and 1609, outside air reduction in Building 1608, and the installation of a variable air volume system in Building 1609.

D. Currently the hot water heaters in all family housing units have a minimum amount of insulation. Therefore, the installation of one and

one-half inches of fiberglass blanket insulation is recommended for these heaters.

E. At the present time, the Commissary (Building 498) refrigeration equipment rejects heat to the atmosphere through the sewer system. Through the installation of a heat reclaim system, this heat can be utilized to supply the facility's entire heating requirements; and therefore, eliminating the use of the existing #2 oil-fired boiler.

2.1 ECIPS ACCOMPLISHED TO DATE BY THE INSTALLATION

		MBTU'S SAVINGS	
Conversion of 28 Buildings From LPG to #2 Fuel Oil for Heating (FY77)		2,434	
Window Replacement Phase I (FY77)		66,271	
Window Replacement Phase II (FY77)		16,454	
Automation & Surveillance System (FY77)		N/A	
Boiler Plate Crosstie (FY77)		6,608	
Storm Windows & Insulation (FY79)		101,565	
Family Housing Improvements Phase I, II, & III (FY77)		307,154	
Heat Recovery Incinerator (FY80)		112,500	
Energy Related Project, Fuel Storage (FY81)		N/A	
Energy Improvements, Housing (FY81) Night Setback, Vent Dampers & Elec. Ignition		93,809	
	Total	706,795	MBTU'S

MAINTENANCE GOALS -- ENERGY RELATED

Fine Tune Equipment Control		60,000	
Steam Trap Replacement		3	
Lighting Reduction (730,000 KWH)		8,469	
EMCS Operation		N/A	
	Total	68,472	MBTU'S

BMAR

Pipe Insulation		N/A	
Insulated Steel Siding		4,508	
	Total	4,508	MBTU'S
ECIP, Maint. Goals, & BMAR	Total	779,775	MBTU'S

ECIPS savings were taken from "FLW Facilities Energy Plan" (June 80). Other calculations and material for these projects appear in the reference data section of this study [Volume 3, Appendix 2 (Reference Data - Part 6)].

2.2 ECIP & INCREMENT G SUMMARY

ECIPS (1985$)	E/C	B/C	Investment K$
Alter Barracks Ventilation	53	4.6	750
Alter Dining Halls	28	2.2	571
Alter Central Plants (ECIP)	26	2.9	754
EMCS	21	2.1	6179
Building Envelope Improvements (ECIP)	23	3.0	2313
Alter Specker Complex Windows	14	2.3	879
Eventual Sub Total			11446

Increment G (1982$)	E/C	B/C	Investment K$
Install Flow Restrictors (MFH)	333.6	11.4	84
Install Flow Restrictors (Bach. Hsg.)	266	17.1	72
Mechanical Alterations	104	2.7	58
Add HWH Insulation (MFH)	99	3.6	75
Install Heat Reclaim	36	4.4	40
Sub Total			329
Total			11775

2.2.1 ECIP RECOMMENDATIONS

1. COMPONENT	FY 1984 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		9-10-81

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Leonard Wood	Alter Barracks Ventilation (ECIP)

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
	72100	200	750

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Primary Facilities				680
Alter 600 Area Barracks	EA	10	13,681	(137)
Alter 700 & 800 Area Barracks	EA	20	27,169	(543)
Sub Total				680
Contingency (5%)				34
Total Contract Cost				714
Supervision, Inspection & Overhead (5%)				36
Total Request				750

10. DESCRIPTION OF PROPOSED CONSTRUCTION

Work will consist of mechanical and electrical alterations to 30 barracks to conserve energy by providing mechanical controlled ventilation IAW AR 40-5" in lieu of the open window system now in effect. Ten buildings in the 600 area will have a heating coil installed in the existing central air handling systems with connections to existing hot water heating system. Twenty buildings in the 700 and 800 area will have two new heating and ventilating units installed in the existing fan rooms with connections to the existing hot water heating system and ductwork connections to each floor. Controls will be modified or installed to provide new winter operation of mechanical ventilation systems.

The building numbers affected are 627, 628, 629, 634, 635, 651, 652, 654, 659, 660, 730, 731, 736, 737, 738, 747, 748, 755, 756, 757, 815, 816, 817, 818, 819, 827, 828, 829, 830 and 831.
B/C Ratio: 4.6; E/C Ratio: 53; Energy Savings: 40,000 MBTU/year

11. REQUIREMENT: This project is required in order to meet the Army's stated goals for energy use reduction in existing facilities. This project is submitted under the Energy Conservation Investment Program (ECIP).

CURRENT SITUATION: The barracks are currently heated by perimeter radiation with no provision for outside air. In order to combat respiratory infection AR 40-5 requires that a minimum of 10 CFM per person be provided by the HVAC system or that windows be left open 1-1/2 inches to provide ventilation to the living space. Leaving windows open in this fashion results in excessive outside air which cannot be effectively controlled. The existing system must

1. COMPONENT	FY 1984 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		9-10-81

3. INSTALLATION AND LOCATION

Fort Leonard Wood, Missouri

4. PROJECT TITLE	5. PROJECT NUMBER
Alter Barracks Ventilation (ECIP	200

be altered or new system installed to provide the minimum outside air requirement automatically under a carefully controlled operation.

IMPACT IF NOT PROVIDED: If this project is not completed, energy consumption will continue at its present rate as costs rise and the supply diminishes.

This project has been reviewed and it has been determined that an EIS pursuant to PL 91-190 is not required.

Estimated Construction Start: April 1984 Index 2887
Estimated Midpoint of Construction: September 1, 1984 Index 3008
Estimated Construction Completion: January 15, 1985 Index 3086

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT LEONARD WOOD 600 700 & 800 AREA FY 1984
PROJECT: ALTER BARRACKS VENTILATION (ECIP)
ECON. LIFE: 15 YRS. DATE: 9 / 15 / 81 PREPARED BY: REK & ASSOCIATES

COST	
1. Non-recurring Initial Capital Costs:	
a. Current Working Estimate	$ 750,000.
b. Design	$ 43,000.
c. Salvage	$ 0.
d. Total	$ 793,000.
BENEFITS	
2. Recurring Benefit/Cost Differential Other Than Energy:	
a. Annual Labor Decrease (+)/Increase (-)	$ -12,647./YR.
b. Annual Material Decrease (+)/Increase (-)	$ -2,838./YR.
c. Other Annual Decrease (+)/Increase (-)	$ 0./YR.
d. Total Costs	$ -15,485./YR.
e. 10% Discount Factor	$ 7.980
f. Discounted Recurring Cost (d x e)	$ -123,570.
3. Recurring Energy Benefit/Costs:	
a. Type of Fuel: NO.6 OIL	
(1) Annual Energy Decrease (+)/Increase (-)	46,980.MBTU
(2) Cost per MBTU	$ 6.53/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$ 306,779./YR.
(4) Differential Escalation Rate (8%) Factor	13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$4,022,490.
b. Type of Fuel:ELECTRICITY	
(1) Annual Energy Decrease (+)/Increase (-)	-6,980.MBTU
(2) Cost per MBTU	$ 3.19/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$ -22,266./YR.
(4) Differential Escalation Rate (7%) Factor	12.278
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$ -273,384.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))	$3,749,110.
4. Total Benefits (Sum 2f + 3e)	$3,625,540.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)	$ 4.6
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))	40,000.
7. E/C Ratio (Line 6 /Line 1a/1000)	53.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$ 269,028.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)	2.8

1. COMPONENT	FY 1984 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		SEPT. 1981

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
FORT LEONARD WOOD, MISSOURI	ALTER DINING HALLS (ECIP)

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
	72210	201	571

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Primary Facilities				518
Replace Range Hoods in 600, 700, 800 and 1000 Area Dining Halls	EA.	14	$34,865	(488)
Alter Exhaust System in Dining Halls 1740 and 1750	EA.	2	14,834	(30)
Subtotal				518
Contingency (5%)				26
Total Contract Cost				544
Supervision, Inspection and Overhead (5%)				27
Total Request				571

10. DESCRIPTION OF PROPOSED CONSTRUCTION

Alterations to Buildings 630, 632, 653, 657, 735, 739, 749, 754, 820, 821, 836, 837, 1010, and 1011 consist of removing the existing hood over the ranges and fryers, modification of existing ductwork and installing new stainless steel short circuit hoods that utilize outdoor air without requiring heat.

Alterations to Building 1740 and 1750 consist of replacing the large serving line exhaust fan with two small exhuast fans to allow one half of the serving line to be shut down during reduced operations and reducing the exhaust requirements with air balancing that saves heated make-up air.
B/C Ratio: 2.2; E/C Ratio: 28; Energy savings: 15,928 MBTU/year

11. REQUIREMENT:
This project is required in order to meet the Army's stated goals for energy use reduction in existing facilities. This project is submitted under the Energy Conservation Investment Program (ECIP).

CURRENT SITUATION: At the present, the dining halls in the 600, 700, 800 and 1000 areas have exhaust hoods of the old variety which remove conditioned air from the space at a high rate. The make-up air must be heated to provide the desired temperature in the space. This results in large energy expenditure which is not necessary. Dining Halls 1740 and 1750 have operations which are quite variable throughout the year, depending on the fluctuation of the Reserve and National Guard load. The present system is designed for 100 per cent on or off with no capability for intermediate operation. This results in unnecessary energy use.

1. COMPONENT	FY 1984 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		SEPT. 1981

3. INSTALLATION AND LOCATION

FORT LEONARD WOOD, MISSOURI

4. PROJECT TITLE	5. PROJECT NUMBER
ALTER DINING HALLS (ECIP)	201

IMPACT IF NOT PROVIDED: If this project is not completed, energy consumption will continue at its present rate as costs rise and the supply diminishes.

This project has been reviewed and it has been determined that an EIS pursuant to PL 91-190 is not required.

Estimated Construction Start:	April 1984	Index 2887
Estimated Midpart of Construction:	October 1984	Index 3035
Estimated Construction Completion:	April 1984	Index 3117

DD FORM 1 DEC 76 1391c

MAY BE USED INTERNALLY UNTIL EXHAUSTED

FOR OFFICIAL USE ONLY (WHEN DATA IS ENTERED)

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT LEONARD WOOD ALL DINING HALLS FY 1984
PROJECT: ALTER DINING HALLS (ECIP)
ECON. LIFE: 15 YRS. DATE: 9 / 15 / 81 PREPARED BY: REK & ASSOCIATES

COST		
1. Non-recurring Initial Capital Costs:		
a. Current Working Estimate	$	571,000.
b. Design	$	32,600.
c. Salvage	$	0.
d. Total	$	603,600.
BENEFITS		
2. Recurring Benefit/Cost Differential Other Than Energy:		
a. Annual Labor Decrease (+)/Increase (-)	$	0./YR.
b. Annual Material Decrease (+)/Increase (-)	$	0./YR.
c. Other Annual Decrease (+)/Increase (-)	$	0./YR.
d. Total Costs	$	0./YR.
e. 10% Discount Factor	$	0.000
f. Discounted Recurring Cost (d x e)	$	0.
3. Recurring Energy Benefit/Costs:		
a. Type of Fuel: NO.6 OIL		
(1) Annual Energy Decrease (+)/Increase (-)		15,771.MBTU
(2) Cost per MBTU	$	6.53/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	102,985./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))		$1,350,330.
b. Type of Fuel:ELECTRICITY		
(1) Annual Energy Decrease (+)/Increase (-)		157.MBTU
(2) Cost per MBTU	$	3.19/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	501./YR.
(4) Differential Escalation Rate (7%) Factor		12.278
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	6,149.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))		$1,356,480.
4. Total Benefits (Sum 2f + 3e)		$1,356,480.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)	$	2.2
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))		15,928.
7. E/C Ratio (Line 6 /Line 1a/1000)		28.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$	103,485.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)		5.5

1. COMPONENT	FY 1985 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		1 Dec. 81

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Leonard Wood, Missouri	Alter Central Plants (ECP)

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
	82120	202	754

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Install economizers, 5 plants	job	1	-	595
Install blowdown heat recovery, 3 plants	job	1	-	89
Subtotal				684
Contingency (5%)				34
Total Contract Cost				718
Supervision, Inspection & Overhead (5%)				36
Total Request				754

10. DESCRIPTION OF PROPOSED CONSTRUCTION The project consists of modifications to five central heating plants to increase operational efficiency. Stack gas economizers will be installed on all five plants, (311, 645, 745, 1021 and 2369) and blowdown heat recovery systems will be installed on the three steam plants (311, 645, 745).

B/C Ratio: 2.9 E/C Ratio: 26 Energy Saved: 19,886 MBTU/yr.
Payback: 4.3 years

11. PROJECT: Provide and install stack gas economizers in all of the five central heating plants and provide and install blowdown heat recovery systems in three of the five.

REQUIREMENT: This project is required to help meet the Army's stated goals for energy use reduction in existing facilities. This project is submitted under the Energy Conservation Investment Program (ECIP).

CURRENT SITUATION: With the present configuration of the central plants, usable waste heat is being rejected into the atmosphere out the stacks or into the sewer through the blowdown system. Modifications are necessary to allow recovery of this heat and improve the efficiency of the central plants.

1. COMPONENT	FY 1985 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		1 Dec 81

3. INSTALLATION AND LOCATION

Fort Leonard Wood, Missouri

4. PROJECT TITLE	5. PROJECT NUMBER
Alter Central Plants	202

IMPACT IF NOT PROVIDED: If this project is not completed, energy consumption will continue at its present rate as costs rise and the supply diminishes.

This project has been reviewed and it has been determined that an EIS pursuant to PL 91-190 is not required.

WAYNE L. LUCAS
Colonel, CE
Facilities Engineer

Date

C. J. FIALA
Major General, USA
Commanding

Date

Estimated Construction Start: 1 April 85 Index: 3117
Estimated Midpoint of Construction: 1 July 85 Index: 3183
Estimated Construction Completion: 1 October 85 Index: 3269

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT LEONARD WOOD CENTRAL PLANTS FY 1985
PROJECT: ALTER CENTRAL PLANTS (ECIP)
ECON. LIFE: 15 YRS. DATE: 11 / 24 / 81 PREPARED BY: JLC & ASSOCIATES

COST		
1. Non-recurring Initial Capital Costs:		
a. Current Working Estimate	$	754,000.
b. Design	$	45,200.
c. Salvage	$	0.
d. Total	$	799,200.
BENEFITS		
2. Recurring Benefit/Cost Differential Other Than Energy:		
a. Annual Labor Decrease (+)/Increase (-)	$	0./YR.
b. Annual Material Decrease (+)/Increase (-)	$	0./YR.
c. Other Annual Decrease (+)/Increase (-)	$	0./YR.
d. Total Costs	$	0./YR.
e. 10% Discount Factor		0.000
f. Discounted Recurring Cost (d x e)	$	0.
3. Recurring Energy Benefit/Costs:		
a. Type of Fuel: NO.6 OIL		
(1) Annual Energy Decrease (+)/Increase (-)		19,886.MBTU
(2) Cost per MBTU	$	8.91/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	177,184./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))		$2,323,240.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))		$2,323,240.
4. Total Benefits (Sum 2f + 3e)		$2,323,240.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)		2.9
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))		19,886.
7. E/C Ratio (Line 6 /Line 1a/1000)		26.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$	177,184.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)		4.3

1. COMPONENT	FY 1985 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		20July82

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Leonard Wood, Missouri	Energy Monitoring and Control System (EMCS)

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
		205	$6179

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Install Central System	LS			1653
Install Building Systems	LS			3202
Control Modifications	LS			750
Subtotal				5605
Contingency (5%)				280
Total Contract Cost				5885
Supervision, Inspection & Overhead (5%)				284
Total Requested				6179

10. DESCRIPTION OF PROPOSED CONSTRUCTION Install a complete Energy Monitoring and Control System (EMCS) to include upgrade of the existing automation and surveillance system MCR to current EMCS standards, installing field interface devices, building system sensors and controllers, radio frequency (RF) interface, and controls and modification to building controls to make the system effective. See 1391C for a definitive list of facilities involved and the system proposed.

B/C: 2.1; E/C:25.5; Payback:6.8 years; Savings:157,433MBTU, $912,107/year.

11. REQUIREMENT: This project is required in order to help meet the Army's stated goals for energy use reduction in existing facilities. This project is submitted under the Energy Conservation Investment Program.

CURRENT SITUATION: The buildings and systems proposed for EMCS and RF interface presently are operating on independent control systems which do not have the capability to optimize start/stop operations, accurately setback temperature, or make the continuous adjustments necessary to reduce energy consumption to the minimum required to satisfy given conditions. The current central computer system is not capable of providing that capability.

1. COMPONENT	FY 1985 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		20July82

3. INSTALLATION AND LOCATION

Fort Leonard Wood, Missouri

4. PROJECT TITLE	5. PROJECT NUMBER
Energy Monitoring and Control System (EMCS)	205

IMPACT IF NOT PROVIDED: If this project is not completed, energy consumption will continue at its present rate as costs rise and the supply diminishes.

This project has been reviewed and it has been determined that an EIS pursuance to PL91-190 is not required.

Wayne L. Lucas
Colonel, EC
Facilities Engineer

Date

C. J. Fiala
Major General, USA
Commanding

Date

Estimated Construction Start: 1 April 85, Index 3117
Estimated Midpoint of Construction: 1 July 85, Index 3183
Estimated Construction Completion: 1 October 85, Index 3269

1. COMPONENT	FY 1985 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		20July82

3. INSTALLATION AND LOCATION

Fort Leonard Wood, Missouri

4. PROJECT TITLE	5. PROJECT NUMBER
Energy Monitoring and Control System (EMCS)	205

Facilities Involved
EMCS

1	606	748	1009	2314	2553
10	607	749	1010	2320	2563
200	625	750	1021	2321	2565
201	626	752	1022	2322	2580
202	630	753	1025	2323	2843
204	631	754	1100	2324	2844
269	632	755	1101	2325	2845
282	633	756	1301	2326	3075
311	636	757	1307	2332	5007
312	637	773	1383	2333	5050
315	638	780	1390	2334	5051
318	645	781	1400	2335	5150
319	650	801	1408	2336	
400	657	804	1413	2337	
401	658	822	1448	2338	
403	672	832	1601	2339	
404	673	836	1607	2341	
408	680	838	1608	2342	
427	681	840	1609	2344	
450	732	841	1701	2345	
451	733	842	1702	2346	
456	734	843	1703	2347	
473	735	844	1704	2348	
486	740	872	1705	2350	
490	741	881	1706	2351	
493	742	990	1707	2369	
498	743	991	1829	2394	
499	744	998	1832	2395	
500	745	999	2104	2399	
590	746	1006	2200	2510	
599	747	1007	2308	2516	

1. COMPONENT	FY 1985 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		20July82

3. INSTALLATION AND LOCATION

Fort Leonard Wood, Missouri

4. PROJECT TITLE	5. PROJECT NUMBER
Energy Monitoring and Control System (EMCS	205

Facilities Involved
RF Interface

170	655	1242	1830	2167	2362	3291
185	656	1244	1831	2175	2363	3292
186	688	1250	1842	2176	2365	3293
231	703	1262	1901	2177	2366	5042
267	713	1270	1902	2185	2368	5047
270	722	1271	1905	2200A	2385	5048
281	760	1272	1908	2200	2500	5049
283	792	1296	1911	2201	2501	5052
286	802	1298	1912	2202	2505	5053
320	811	1302	1913	2203	2511	5056
375	823	1327	1927	2204	2514	5059
384	824	1334	1930	2205	2554	5069
402	825	1342	1938	2206	2555	5070
407	833	1343	1941	2207	2557	5071
409	835	1348	1947	2208	2566	5072
410	838	1349	1953	2212	2831	5075
414	839	1353	1959	2215	2822	5077
416	853	1362	1971	2216	2833	5078
418	880	1363	1978	2217	2834	5079
419	1008	1364	1988	2223	2835	5082
421	1018	1365	1994	2226	2836	5083
429	1023	1409	2055	2250	2838	5084
455	1067	1416	2057	2272	2839	5085
457	1068	1422	2066	2282	2840	6020
458	1134	1446	2101	2310	2841	6150
460	1230	1461	2102	2311	3001	6505
462	1232	1549	2103	2313	3001D	8202
463	1233	1621	2110	2319	3005	8370
464	1234	1650	2111	2346	3007	10221
465	1235	1652	2112	2353	3008	10300
466	1236	1653	2114	2354	3009	10301
467	1237	1656	2115	2355	3010	10302
468	1238	1711	2121	2357	2011	10303
546	1239	1712	2128	2358	3065	10320
565	1240	1714	2137	2359	3067	10321
639	1241	1760	2145	2361	3068	10330
						10332

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT LEONARD WOOD FY 1985
PROJECT: ENERGY MONITORING AND CONTROL SYSTEM
ECON. LIFE: 15 YRS. DATE: 1/15/82 PREPARED BY: JLC
COST

1. Non-recurring Initial Capital Costs:	
a. Current Working Estimate	$ 6,179,000.
b. Design	$ 371,000.
c. Salvage	$ 0.
d. Total	$ 6,550,000.
BENEFITS	
*2. Recurring Benefit/Cost Differential Other Than Energy:	
a. Annual Labor Decrease (+)/Increase (-)	$ -618,000./YR
b. Annual Material Decrease (+)/Increase (-)	$ 0./YR
c. Other Annual Decrease (+)/Increase (-)	$ ./YR
d. Total Costs	$ -618,000./YR
e. 10% Discount Factor	7.980
f. Discounted Recurring Cost (d x e)	$-4,931,640.
3. Recurring Energy Benefit/Costs:	
a. Type of Fuel: ELECTRICITY	
(1) Annual Energy Decrease (+)/Increase (-)	52,315.MBTU
(2) Cost per MBTU	$ 2.44/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$ 127,648./YR
(4) Differential Escalation Rate (7%) Factor	12.278
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$ 1,567,270.
b. Type of Fuel: #6 OIL	
(1) Annual Energy Decrease (+)/Increase (-)	19,094.MBTU
(2) Cost per MBTU	8.91/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$ 170,128./YR
(4) Differential Escalation Rate (8%) Factor	13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$ 2,230,712.
c. Type of Fuel: #2 OIL	
(1) Annual Energy Decrease (+)/Increase (-)	76,993.MBTU
(2) Cost per MBTU	$ 14.75/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$ 1,135,647./YR
(4) Differential Escalation Rate (8%) Factor	13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$14,890,600.
d. Type of Fuel: LPG	
(1) Annual Energy Decrease (+)/Increase (-)	9,031.MBTU
(2) Cost per MBTU	$ 9.18/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$ 82,905./YR
(4) Differential Escalation Rate (8%) Factor	13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$ 1,087,045.

e. Electrical Demand		
(1) Annual Energy Decrease (+)/Increase (-)		0.MBTU
(2) Cost per MBTU	$	0./MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	13,780./YR
(4) Differential Escalation Rate (7%) Factor		12.278
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	169,191.
f. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))		$18,857,773.
4. Total Benefits (Sum 2f + 3e)		$13,926,133.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)		2.1
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))		157,433.
7. E/C Ratio (Line 6/Line 1a/1000)		25.5
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$	912,107.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)		6.8

*Recurring Benefit/Cost Differential Other Than Energy

Annual Labor Decrease (+)/Increase (-)

This value is 10% of the CWE and is included for annual cost of maintenance of system hardware and DTM. The 10% value is as suggested in document HNDSP80-013-EDME.

1. COMPONENT	FY 1985 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		15 Jan 85

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Leonard Wood, Missouri	Building Envelope Improvements (ECIP)

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
		204	2188

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Wall Insulation	SF	668,838	0.40	268
Drywall	SF	140,202	1.05	147
Ceiling Insulation	SF	322,120	0.50	161
Floor Insulation	SF	324,283	0.49	159
Metal Skirting	SQ	1,401	256.00	359
Window Replacement	EA	2,391	265.00	634
Door Replacement	EA	365	304.00	111
Block in Windows	EA	2,113	68.90	146
Sub Total				1985
Contingency (5%)				99
Total Contract Cost				2084
Supervision, Inspection & Overhead (5%)				104
Total Request				2188

10. DESCRIPTION OF PROPOSED CONSTRUCTION: Project upgrades buildings to current standards of energy efficiency by providing wall, ceiling and floor insulation and skirting, replacing windows and doors, and blocking up excessive window openings.

B/C: 4.1; E/C: 23; Payback: 3 years; Savings: 51,343 MBTU, $721,205/year.

11. PROJECT: Provide and install wall insulation, interior sheetrock where needed, ceiling insulation, floor insulation, skirting, window and door replacement, and block in excess windows as required.

REQUIREMENT: This project is required to help meet the Army's stated goals for energy use reduction in existing facilities. This project is submitted under the Energy Conservation Investment Program (ECIP).

CURRENT SITUATION: The buildings being retrofited are wood frame structures constructed in the 1940's at a time when energy was inexpensive and plentiful. There is no insulation in the walls, some walls do not have interior drywall, no insulation in the floors, only a bare 2" of insulation in the ceiling, loose fitting single pane windows, loose fitting doors and excessive window areas.

IMPACT IF NOT PROVIDED: If this project is not completed, energy consumption will continue at its present rate as costs rise and the supply diminishes.

1. COMPONENT	FY 1985 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		15 Jan 85

3. INSTALLATION AND LOCATION

Fort Leonard Wood, Missouri

4. PROJECT TITLE	5. PROJECT NUMBER
Building Envelope Improvements (ECIP)	204

This project has been reviewed and it has been determined that an EIS pursuant to PL 91-190 is not required.

WAYNE L. LUCAS
Colonel, CE
Facilities Engineer

Date

C. J. FIALA
Major General, USA
Commanding

Date

Estimated Construction Start: 1 April 1985 Index: 3117
Estimated Midpoint of Construction: 1 October 1985 Index: 3269
Estimated Construction Completion: 1 April 1986 Index: 3357

EDM
Engineering Design & Management Inc.

1101 Lucas Avenue
Box 1159
St. Louis, Missouri 63188
314-231-5485

Ft. Leonard Wood

Erratum Sheet FLW EEAP, Volume 1A, Executive Summary:
Contract No. DACA45-80-C-0143
(Final Submittal Dated July, 1982).

P. 2-25 - Economic Life should be changed to 25 years.

PP. 2-40 & 2-41 - Delete these pages from the volume.

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT LEONARD WOOD BLDGS. POST WIDE FY 1985
PROJECT: BUILDING ENVELOPE IMPROVEMENTS
ECON. LIFE: 15 YRS. DATE: 1 / 15 / 82 PREPARED BY: JLC

COST		
1. Non-recurring Initial Capital Costs:		
a. Current Working Estimate		$2,188,000.
b. Design		$ 125,000.
c. Salvage		$ 0.
d. Total		$2,313,000.
BENEFITS		
2. Recurring Benefit/Cost Differential Other Than Energy:		
a. Annual Labor Decrease (+)/Increase (-)	$	0./YR.
b. Annual Material Decrease (+)/Increase (-)	$	0./YR.
c. Other Annual Decrease (+)/Increase (-)	$	0./YR.
d. Total Costs	$	0./YR.
e. 10% Discount Factor		0.000
f. Discounted Recurring Cost (d x e)	$	0.
3. Recurring Energy Benefit/Costs:		
a. Type of Fuel: PROPANE		
(1) Annual Energy Decrease (+)/Increase (-)		6,482.MBTU
(2) Cost per MBTU	$	9.18/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	59,505./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	780,226.
b. Type of Fuel:NO.2 OIL		
(1) Annual Energy Decrease (+)/Increase (-)		44,861.MBTU
(2) Cost per MBTU	$	14.75/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	661,700./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))		$8,676,210.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))		$9,456,430.
4. Total Benefits (Sum 2f + 3e)		$9,456,430.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)		4.1
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))		51,343.
7. E/C Ratio (Line 6 /Line 1a/1000)		23.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$	721,205.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)		3.0

PGA Engineers Incorporated
The Equitable Building
522 Olive
St. Louis, Missouri 63101

SHEET NO. 1 OF 1 JOB NO. 15195

SUBJECT FILE

FLW - FBH EEAP

TITLE: FT. LEONARD WOOD BUILDING ENVELOPE IMPROVEMENTS
Fuel Type: (PROPANE)

BY GDC DATE 1-15-82 CHECKED DATE

BLDG. NO.	NEW DOORS	NEW WINDOW	CLOSING UP WINDOWS	INTERIOR DRYWALL COVERING (SQ.ft.)	WALL INSULATION (SQ.ft.)	CEILING INSULATION (SQ.ft.)	FLOOR INSULATION (SQ.ft.)	METAL SKIRTING (SQ)
443, 444, 448	2	34	6		5000	1638	3275	12
455, 466, 467	7	34	63		13,460			20
583, 376, 546			5		8300	3666	4498	16
1273	2							4.5
1274	2							4.5
1276	2							4.5
1301	2	17	16		2160	1222	2444	7.2
1332		13	13		2160	1222	2444	7.2
1350	2	20	19		3774	1215	2430	5.1
1404	2	20	19	3774	3774	1215	2430	5
1458	2	20	19	3774	3774	1215	2430	5
1459	2	20	19	3774	3774	1215	2430	5
1460	2	20	19	3774	3774	1215	2430	5
1465	2	20	19	3774	3774	1215	2430	5
1489	2	20	19	3774	3774	1215	2430	4.5
1656	2	20	19		3774	1215	2430	5
2208		4				4176		
2350	3	20	15	2848	6700	9064		
3014		4	4		1332	624	1248	5
3015		6	5		1476	728		
3016		8	7		1764	936	1872	3
3075					6000	1800	3800	8
Total	36	300	286	25492	78544	33581	39021	132

30,192

2-26

OK ✓

PGA Engineers Incorporated
The Equitable Building
522 Olive
St. Louis, Missouri 63101

SHEET NO. 1 OF 9 JOB NO. 15195

SUBJECT FILE
FLW - FBH EEAP

TITLE: FT. LEONARD WOOD
BUILDING ENVELOPE IMPROVE-
MENTS Fuel Type: (NO.2 Fuel oil)

BY GDC DATE 1-15-82 CHECKED DATE

BLDG. NO.	NEW DOORS	NEW WINDOWS	CLOSING UP WINDOWS	INTERIOR DRYWALL COVERING (SQ.ft.)	WALL INSULATION (SQ.ft.)	CEILING INSULATION (SQ.ft.)	FLOOR INSULATION (SQ.ft.)	METAL SKIRTING (SQ)
200		12	12		2106	1183	2366	
201	5	14	13		4440	2400	4800	
202	5	17	6		3312	1900	3800	8
231		6	6		1404	676	1352	
252	2	20	19		3774	1215	2430	5
253		6	6		1404	676	1352	
266	2	20	19		3774	1215	2430	5
268		6	6		1404	676	1352	
269	2	10	9		2498	3106	3106	6
270		6	6		1296	598	1196	5
273	2	20	19		3774	1215	2430	5
274		6	6		1404	676		
275	2	20	19		3774	1215	2430	5
276	2	20	19		3774	1215	2430	5
277		8	7		1296	598	1196	5
278	2	20	19		3774	1215	2430	5
405	8	30	8		14,300	5109	10,216	35
406	8	30	8		14,300	5109	10,216	35
418	2	7		2000	4590	3108		
507	1	4	3					
508		13	13		2160	1222	2444	7
512		13	12		2160	1222	2440	5
514		12	12					5
532		6	6		1404	676		
533		11	11		1620	832	1664	6
588	4	17	21		3400	1040	2080	17
589	4	17	21		3400	1040	2080	17
1067	32	10	18					
1231	2				2700	1612	3224	12
1233					1404	676		
1235			2-27		1404	676		
1237					2160	1222	2444	7
	85	381	324	2000	98210	43323	71908	200

PGA Engineers Incorporated
The Equitable Building
522 Olive
St. Louis, Missouri 63101

SHEET NO. 2 OF 9 | JOB NO. 15195

SUBJECT FILE

FLW - FBH EEAP

TITLE: FT. LEONARD WOOD BUILDING ENVELOPE IMPROVEMENTS Fuel Type: (No. 2 Fuel oil)

BY GDC DATE 1-15-82 CHECKED _____ DATE _____

BLDG. NO.	NEW DOORS	NEW WINDOWS	CLOSING UP WINDOWS	INTERIOR DRYWALL COVERING (SQ.ft.)	WALL INSULATION (SQ.ft.)	CEILING INSULATION (SQ.ft.)	FLOOR INSULATION (SQ.ft.)	METAL SKIRTING (SQ)
1238					1296	598	1196	4
1243					1296	598	1196	4
1245					1296	598	1196	4
1256					1296	598	1196	4
1257					1296	598	1196	3.6
1258					2160	1222	2444	7
1260	2							5.1
1261	2							5.1
1265					2160	1222	2444	6.2
1270					1404	676		
1271					2160	1222	2444	21.6
1272	1				1296	598	1196	4
1275								4.5
1277	1				1296	598	1196	3.6
1281		13	12		2160	1222	2444	7.2
1282								4.5
1284								4.5
1285								4.5
1287								4.5
1302		16	5		4440	2400	4800	12
1311		11			2448	1430	2860	8
1315		13	13		2160	1222	2444	7.2
1316	2	20	19		3774	1215	2430	5.1
1317	2	20	19		3774	1215	2430	5.1
1318		5	5		1404	676		
1319		13	13		2160	1222	2444	7.2
1320		5	5		1404	676		
1321	2	20	19		3774	1215	2430	5.1
1322	2	20	19		3774	1215	2430	5.1
1324		6	5		1296	1196	1296	4.2
1327		5	5		1404	676		
1328		11			2160	1222	2444	7.2
	14	178	139	2-28	53088	25,330	44,156	168.1

PGA Engineers Incorporated
The Equitable Building
522 Olive
St. Louis, Missouri 63101

SHEET NO. 3 OF 9 JOB NO. 15195

SUBJECT FILE
FLW - FBH EEAP

TITLE: FT. LEONARD WOOD BUILDING ENVELOPE IMPROVEMENTS
Fuel Type: (No. 2 Fuel oil)

BY GDC DATE 1-15-82 CHECKED DATE

BLDG. NO.	NEW DOORS	NEW WINDOWS	CLOSING UP WINDOWS	INTERIOR DRYWALL COVERING (SQ.FT.)	WALL INSULATION (SQ.FT.)	CEILING INSULATION (SQ.FT.)	FLOOR INSULATION (SQ.FT.)	METAL SKIRTING (SQ)
1329		5	5		1404	676		
1333		6	5		1296	598	1296	4.2
1334	2	13	13		2160	1222	2444	7.2
1336		5	5		1404	676		
1337		5	5		1404	676		
1339		13	13		2160	1222	2444	7.2
1340	2	20	19		3774	1215	2430	5.1
1341	2	20	19		3774	1215	2430	5.1
1342		5	5		1404	676		
1343		6	5		1296	598	1196	3.6
1344		11	11		2160	1222	2444	7.2
1345		6	5		1296	598	1296	4.2
1346	2	20	19		3774	1215	2430	5.1
1347	2	20	19		3774	1215	2430	5.1
1348		5	5		1404	676		
1349		5	5		1404	676		
1352		6	5		1296	1196	1296	4.2
1353		13	13		2160	1222	2444	7.2
1354		5	5		1404	676		
1357	2	20	19		3774	1215	2430	5.1
1362		5	5		1404	676		
1364		6	5		1296	598	1296	4.2
1365	2	13	13		2160	1222	2444	7.2
1366		6	5		1296	598	1296	4.2
1367	2	20	19		3774	1215	2430	5.1
1369		6	5		1404	676		
1370		5	5		1404	676		
1373	2	13	13		2160	1222	2444	7.2
1374		6	5		1296	598	1196	3.6
1375		6	5		1296	598	1196	3.6
1376		6	5		1404	676		
1377	2	13	13		2160	1222	2444	7.2
	20	314	298	2-29	63576	28662	41756	112.8

PGA Engineers Incorporated
The Equitable Building
522 Olive
St. Louis, Missouri 63101

SHEET NO. 4 OF 9 JOB NO. 15195

SUBJECT FILE

FLW - FBH EEAP

TITLE: FT. LEONARD WOOD BUILDING ENVELOPE IMPROVE-MENTS Fuel Type: (No 2 Fuel oil)

BY GDC DATE 1-15-82 CHECKED DATE

BLDG. NO.	NEW DOORS	NEW WINDOWS	CLOSING UP WINDOWS	INTERIOR DRYWALL COVERING (Sq.ft.)	WALL INSULATION (Sq.ft.)	CEILING INSULATION (Sq.ft.)	FLOOR INSULATION (Sq.ft.)	METAL SKIRTING (SQ)
1405		8	7		1296	598	1196	3
1407	2	5	5	1404	1404	676		
1411		5	5		1400	676		
1462		13	12	2160	2160	1222	2444	7.2
1463		8	7		1296	598	1196	14.3
1466	2	20	19	3774	3774	1215	2430	5
1477		13	12	2160	2160	1222	2444	7.2
1478		13	12	2160	2160	1222	2444	7.2
1479		13	12	2160	2160	1222	2444	7.2
1480		8	7	1296	1296	598	1196	14.3
1483	2	5	5	1404	1404	676		15.4
1485	2	5	5	1404	1404	676		15.4
1486		8	7	1296	1296	598	1196	2.1
1490	2	5	5	1404	1404	676		15.4
1491	2	5	5	1404	1404	676		15.4
1494		13	12	2160	2160	1220	2444	7.2
1497	2	20	19	3774	3774	1215	2430	4.5
1498	2	20	19	3774	3774	1215	2430	4.5
1650		17	5		1620	832	1664	5.4
1651		13	10		1620	832	1664	5.4
1652	4	16	16		2826	2420	2860	8.2
1653		21	20		2520	1482	2964	9.3
1677		15	14		2538	1495	2990	8.5
1679		5	4		1404	676		
1680		10	9		2683	1430		
1683		5	5		1404	676		
1684		15	14		2538	1495	2990	8.5
1686		15	14		2538	1495	2990	8.5
1687		9	9		2448	1430		
1688	2	20	19		3774	1215	2430	5
1698	2	20	19		3774	1215	2430	5
	24	368	333	31734	67413	32894	47276	209.1

PGA Engineers Incorporated
The Equitable Building
522 Olive
St. Louis, Missouri 63101

SHEET NO. 5 OF 9 | JOB NO. 15195

SUBJECT FILE: FLW - FBH EEAP

TITLE: FT. LEONARD WOOD BUILDING ENVELOPE IMPROVE-MENTS
Fuel Type: (No. 2 Fuel oil)

BY GDC DATE 1-15-82 | CHECKED ____ DATE ____

BLDG. NO.	NEW DOORS	NEW WINDOW	CLOSING UP WINDOWS	INTERIOR DRYWALL COVERING (SQ.ft.)	WALL INSULATION (Sq.ft.)	CEILING INSULATION (Sq.ft.)	FLOOR INSULATION (Sq.ft.)	METAL SKIRTING (SQ)
1699	2	20	19		3774	1215	2430	5
1751	4	28	28		5440	1950	3900	9
1753	3	30	28		5440	1950	3900	10
1900					10240	3500	7800	20
1901					1620	832	1664	6
1902					2106	1183	2366	7
1904					2106	1222	2444	10
1905	6				3142	1850	3700	11
1907	4	28	28		5440	1950	3900	9
1908					2160	1183	2366	7
1909	2	20	19		3774	1215	2400	5
1910	2				2430	1417	2834	9
1911					1620	832		
1912					1404	676		4.9
1913								8
1916	2				3774	1215		5.1
1917	2				3774	1215		5.1
1918	2				3774	1215		5.1
1919					1404	676		4.2
1920	8	20	14		3000	1651	3302	24
1925					2736	1430		9
1926	2							5.1
1929	2					1215	2430	5.1
1930					1404	676		
1931						1215	2430	5.1
1932						1215	2430	5.1
1933					2736	1430		9
1934	2				3774	1215		5.1
1935	2				3774	1215		5.1
1936					1404	676		
1937	2				3774	1215		5.1
1938					1404	676		
	47	146	136		87428	39525	50296	218.1

PGA Engineers Incorporated
The Equitable Building
522 Olive
St. Louis, Missouri 63101

SHEET NO. 6 OF 9 | JOB NO. 15195

SUBJECT FILE: FLW - FBH EEAP

TITLE: FT. LEONARD WOOD BUILDING ENVELOPE IMPROVE-MENTS Fuel Type: (No. 2 Fuel oil)

BY GDC DATE 1-15-82 | CHECKED ____ DATE ____

BLDG. NO.	NEW DOORS	NEW WINDOW	CLOSING UP WINDOWS	INTERIOR DRYWALL COVERING (Sq.ft.)	WALL INSULATION (Sq.ft.)	CEILING INSULATION (Sq.ft.)	FLOOR INSULATION (Sq.ft.)	METAL SKIRTING (SQ)
1939	2					1215	2430	5.1
1940	2					1215	2430	5.1
1941					1440	676		
1942	2					1215	2430	5.1
1943	2					1215	2430	5.1
1947	3				4692	1900		8.3
1948					1620	832	1664	6
1950					2730	1430		9
1951	2					1215	2430	5.1
1952	2					1215	2430	5.1
1953					1404	676		
1954	2					1215	2430	5.1
1955	2					1215	2430	5.1
1956					4692	1900		8.3
1957	2					1215	2430	5.1
1958	2							5.1
1959					1404	676		
1960	2				3774	1215		5.1
1961	2				3774	1215		5.1
1962					2736	1430		9
1963					2736	1430		9
1964	2				3774	1215		5.1
1965					1404	676		
1966					1404	676		
1967	2				3774	1215		5.1
1968	2				3774	1215		5.1
1969	2				3774	1215		5.1
1970	2				3774	1215		5.1
1971					1404	676		
1972	2				3774	1215		5.1
1973	2				3774	1215		5.1
1974					2736	1430		9
	41				64374	36278		155.6

PGA Engineers Incorporated
The Equitable Building
522 Olive
St. Louis, Missouri 63101

SHEET NO. 7 OF 9 | JOB NO. 15195

SUBJECT FILE: FLW - FBH EEAP

TITLE: FT. LEONARD WOOD BUILDING ENVELOPE IMPROVEMENTS Fuel Type: (No. 2 Fuel oil)

BY GDC DATE 1-15-82 | CHECKED ____ DATE ____

BLDG. NO.	NEW DOORS	NEW WINDOWS	CLOSING UP WINDOWS	INTERIOR DRYWALL COVERING (Sq.ft.)	WALL INSULATION (Sq.ft.)	CEILING INSULATION (Sq.ft.)	FLOOR INSULATION (Sq.ft.)	METAL SKIRTING (SQ)
1978					1401	676		
1980	2				3774	1215		5.1
1981	2				3774	1215		5.1
1982					2736	1430		9
1983	2				3774	1215		5.1
1984	2				3774	1215		5.1
1985	2				3774	1215		5.1
1986	2				3774	1215		5.1
1987					2736	1430		9
1988					1404	676		4.9
1989	2				3774	1215		5.1
1990	2				3774	1215		5.1
1991					4692	1900		8.3
1994					2736	1430		9
1995					1404	676		
1996	2				3774	1215		5.1
1997	2				3774	1215		5.1
1998					2736	1430		9
1999	2				3774	1215		5.1
2058		28			3294	500		
2066	8	20	14		3000	1651	3302	24
2207						1667		
2212		5	5			4320		
2215		30	29			6500		
2216		30	29			6500		
2217		8				1815		
2219		15	5			4190		
2220								
2221								
2222		14	14			3945		
2223		6				809		
2303		8	8	2700	2700	813		
	30	164	104	2700	70353	55723	3302	129.3

PGA Engineers Incorporated
The Equitable Building
522 Olive
St. Louis, Missouri 63101

SHEET NO. 8 OF 9 | JOB NO. 15195

SUBJECT FILE

FLW - FBH EEAP

TITLE: FT. LEONARD WOOD BUILDING ENVELOPE IMPRVE-MENTS Fuel Type: (No. 2 Fuel oil)

BY GDC DATE 1-15-82 | CHECKED ____ DATE ____

BLDG. NO.	NEW DOORS	NEW WINDOWS	CLOSING UP WINDOWS	INTERIOR DRYWALL COVERING (SQ. ft.)	WALL INSULATION (SQ. ft.)	CEILING INSULATION (SQ. ft.)	FLOOR INSULATION (SQ. ft.)	METAL SKIRTING (SQ)
2304		8	8	2700	2700	813		
2305		9	9	2700	2700	813		
2306		9	9	2700	2700			
2307		9	9	2700	2700			
2310	4	6	5	1700	1700	500		
2311	4	6	5	1700	1700	500		
2313A	2	6	6	1476	1476	728		
2313	3	8	18	2000	2000	500		
2314	3	8	18	2000	2000	500		
2315	4	19	4	1000	1000	200		
2325		8	4	1000	1000	500		
2326		8	4	1000	1000	500		
2330	10	37	21	3000	3000	7750		
2331	3	20	9	4000	4000	500		
2332	3	20	9	4000	4000	500		
2340	2	8	4	4000	4000	500		
2341	2	8	4	4000	4000	500		
2342	4	8	6	7500	7500	750		
2343	4	8	6	7500	7500	750		
2344	4	13	8	7500	7500	750		
2345	4	13	8	7500	7500	750		
2382	4	5		6600	6600	6600	2330	8
2500		5	5					
2501		5	5					
2505		5	5					
2514		10	10					
2516		56	140					
2555		10	10					
2556		11	11					
2557		11	11					
2558		8	8					
3057		11	11				2834	9
	60	376	390	78276	78276	24904	5164	17

PGA Engineers Incorporated
The Equitable Building
522 Olive
St. Louis, Missouri 63101

SHEET NO. 9 OF 9 | JOB NO. 15195

SUBJECT FILE: FLW - FBH EEAP

TITLE: FT. LEONARD WOOD BUILDING ENVELOPE IMPROVE-MENTS
Fuel Type: (No. 2 Fuel oil)

BY GDC DATE 1-15-82 | CHECKED ____ DATE ____

BLDG. NO.	NEW DOORS	NEW WINDOW	CLOSING UP WINDOWS	INTERIOR DRYWALL COVERING (SQ. ft.)	WALL INSULATION (SQ. ft.)	CEILING INSULATION (SQ. ft.)	FLOOR INSULATION (SQ. ft.)	METAL SKIRTING (SQ)
3065		11	10				2860	9
3066		11	11				2834	9
3067		17	16				2730	8
3068	1	17	16				2730	8
3069	1	17	16				2730	8
3070		17	16				2730	8
3071		6	6				1560	4
3074		10	10				3230	5
5042	3	19	1		2300	1400		
8370	3	39	1		5276	500		
	8	164	103		7576	1900	21404	59
NO. 2 FUEL OIL								
******	*	***	***	****	****	****	****	***
Grand Total	329	2091	1827	114710	590294	288,539	285262	1269
******	*	***	***	****	****	****	****	***

1. COMPONENT	FY 1985 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		7 Jan. 1982

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Leonard Wood, Missouri	Alter Specker Complex Windows (ECIP)

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
		203	879

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Install Double Glazing	SF	55885	14.27	797
Contingency (5%)				40
Total Control				837
Supervision, Inspection and Overhead (5%)				42
Total Request				879

10. DESCRIPTION OF PROPOSED CONSTRUCTION

Work consists of double glazing the existing windows on 45 buildings in the Specker Complex. See 1391C for comprehensive listing.

B/C Ratio: 2.3; E/C Ratio: 14 ; Payback:8.4years; Savings: 12,593 MBTU, 104,647$/yr.

11. PROJECT: Provide and install double glazing in the existing windows in 45 buildings in the Specker Complex.

REQUIREMENT: This project is required to help meet the Army's stated goals for energy use in existing facilities. This project is submitted under the Energy Conservation Investment Program (ECIP).

CURRENT SITUATION: When the Specker Complex was constructed in 1978, the windows installed were a combination of single glazed double hung, hopper and fixed plate glass. This is very inefficient for energy conservation and has led to complaints of draftiness from the occupants. Field surveys show that the windows are tight fittings and that the draftiness observed is mostly from convection or "cold wall" effect. These new windows can be adapted to double glazing without total replacement.

IMPACT IF NOT PROVIDED: If this project is not completed, energy consumption will continue at its present rate as costs rise and the supply diminishes.

1. COMPONENT	FY 19 85 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		7 Jan. 1982

3. INSTALLATION AND LOCATION

Fort Leonard Wood, Missouri

4. PROJECT TITLE	5. PROJECT NUMBER
Alter Specker Complex Windows (ECIP)	203

This project has been reviewed and it has been determined that an E2S pursuance to PL91-190 is not required.

Wayne L. Lucas
Colonel, EC
Facilities Engineer

Date

C. J. Fiala
Major General, USA
Commanding

Date

Estimated Construction Start: 1 April 85, Index 3117
Estimated Midpoint of Construction: 1 July 85, Index 3183
Estimated Construction Completion: 1 October 85, Index 3269

1. COMPONENT	FY 19_85 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		7 Jan. 1982

3. INSTALLATION AND LOCATION

Fort Leonard Wood, Missouri

4. PROJECT TITLE	5. PROJECT NUMBER
Alter Specker Complex Windows (ECIP)	203

SPECKER COMPLEX

BUILDING LIST AND WINDOW AREAS

Bldg. #	Description	SF Window
1700	Supply Storage	156
1701	Admin. and Storage	730
1702	Admin. and Storage	730
1703	Bat. HQ and Classroom	572
1704	Bat. HQ and Classroom	572
1705	Courtroom	240
1706	Admin. and Storage	730
1707	Admin. and Storage	730
1714	Gymnasium	315
1720	Barracks	2349
1721	Service Module	256
1722	Barracks	1158
1723	Barracks	2349
1724	Barracks	1158
1725	Barracks	1158
1726	Barracks	1158
1727	Service Module	256
1728	Barracks	2349
1729	Barracks	2349
1730	Barracks	1158
1731	Barracks	1158
1732	Barracks	1158
1733	Barracks	1158
1734	Barracks	2349
1735	Barracks	2349
1736	Service Modules	256
1740	Dining Hall	1429
1750	Dining Hall	1429
1760	Service Modules	256
1761	Barracks	2349
1762	Barracks	1158
1763	Barracks	1158
1764	Barracks	1158
1765	Barracks	2349
1766	Barracks	1158
1767	Barracks	2349
1168	Barracks	1158
1769	Barracks	2349
1770	Service Modules	256
1771	Barracks	1158
1773	Barracks	2349
1774	Barracks	1158
1775	Barracks	1158
1776	Barracks	2349
		55,885

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT LEONARD WOOD FY 1985
PROJECT: ALTER SPECKER COMPLEX WINDOWS (ECIP)
ECON. LIFE: 25 YRS. DATE: 1 / 7 / 82 PREPARED BY: JLC

COST	
1. Non-recurring Initial Capital Costs:	
a. Current Working Estimate	$ 879,000.
b. Design	$ 50,000.
c. Salvage	$ 0.
d. Total	$ 929,000.
BENEFITS	
2. Recurring Benefit/Cost Differential Other Than Energy:	
a. Annual Labor Decrease (+)/Increase (-)	$ 0./YR.
b. Annual Material Decrease (+)/Increase (-)	$ 0./YR.
c. Other Annual Decrease (+)/Increase (-)	$ 0./YR.
d. Total Costs	$ 0./YR.
e. 10% Discount Factor	0.000
f. Discounted Recurring Cost (d x e)	$ 0.
3. Recurring Energy Benefit/Costs:	
a. Type of Fuel: NO.6 OIL	
(1) Annual Energy Decrease (+)/Increase (-)	11,425.MBTU
(2) Cost per MBTU	$ 8.91/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$ 101,797./YR.
(4) Differential Escalation Rate (8%) Factor	20.050
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$2,041,020.
b. Type of Fuel:ELECTRICITY	
(1) Annual Energy Decrease (+)/Increase (-)	1,168.MBTU
(2) Cost per MBTU	$ 2.44/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$ 2,850./YR.
(4) Differential Escalation Rate (7%) Factor	18.049
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$ 51,438.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))	$2,092,460.
4. Total Benefits (Sum 2f + 3e)	$2,092,460.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)	2.3
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))	12,593.
7. E/C Ratio (Line 6 /Line 1a/1000)	14.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$ 104,647.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)	8.4

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT LEONARD WOOD POST ALTERNATIVE #1 FY 1985
PROJECT: ENERGY MONITORING AND CONTROL SYSTEM
ECON. LIFE: 15 YRS. DATE: 1 / 15 / 82 PREPARED BY: KLD

COST	
1. Non-recurring Initial Capital Costs:	
a. Current Working Estimate	$5,979,000.
b. Design	$ 342,000.
c. Salvage	$ 0.
d. Total	$6,321,000.
BENEFITS	
2. Recurring Benefit/Cost Differential Other Than Energy:	
a. Annual Labor Decrease (+)/Increase (-)	$ -698,000./YR.
b. Annual Material Decrease (+)/Increase (-)	$ 0./YR.
c. Other Annual Decrease (+)/Increase (-)	$ 21,200./YR.
d. Total Costs	$ -676,800./YR.
e. 10% Discount Factor	7.980
f. Discounted Recurring Cost (d x e)	$ -5,400,860.
3. Recurring Energy Benefit/Costs:	
a. Type of Fuel: ELECTRICITY	
(1) Annual Energy Decrease (+)/Increase (-)	8,570.MBTU
(2) Cost per MBTU	$ 2.44/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$ 20,911./YR.
(4) Differential Escalation Rate (7%) Factor	12.278
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$ 256,743.
b. Type of Fuel:#6 OIL	
(1) Annual Energy Decrease (+)/Increase (-)	19,407.MBTU
(2) Cost per MBTU	$ 8.91/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$ 172,916./YR.
(4) Differential Escalation Rate (8%) Factor	13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$2,267,280.
c. Type of Fuel: #2 OIL	
(1) Annual Energy Decrease (+)/Increase (-)	88,975.MBTU
(2) Cost per MBTU	$ 14.75/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$1,312,380./YR.
(4) Differential Escalation Rate (8%) Factor	13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$ 17,207,900.
d. Type of Fuel: LPG	
(1) Annual Energy Decrease (+)/Increase (-)	9,306.MBTU
(2) Cost per MBTU	$ 9.18/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$ 85,429./YR.
(4) Differential Esculation Rate (8%) Factor	13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4)	$1,120,150.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))	$ 20,852,100.
4. Total Benefits (Sum 2f + 3e)	$ 15,451,200.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)	2.4
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))	126,258.
7. E/C Ratio (Line 6 /Line 1a/1000)	21.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$ 914,838.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)	6.5

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT LEONARD WOOD POST ALTERNATIVE #2 FY 1985
PROJECT: ENERGY MONITORING AND CONTROL SYSTEM
ECON. LIFE: 15 YRS. DATE: 1 / 15 / 82 PREPARED BY: KLD
COST

1. Non-recurring Initial Capital Costs:	
a. Current Working Estimate	$6,535,000.
b. Design	$ 373,000.
c. Salvage	$ 0.
d. Total	$6,908,000.
BENEFITS	
2. Recurring Benefit/Cost Differential Other Than Energy:	
a. Annual Labor Decrease (+)/Increase (-)	$ -654,000./YR.
b. Annual Material Decrease (+)/Increase (-)	$ 0./YR.
c. Other Annual Decrease (+)/Increase (-)	$ 21,200./YR.
d. Total Costs	$ -632,800./YR.
e. 10% Discount Factor	7.980
f. Discounted Recurring Cost (d x e)	$ -5,049,740.
3. Recurring Energy Benefit/Costs:	
a. Type of Fuel: ELECTRICITY	
(1) Annual Energy Decrease (+)/Increase (-)	8,570.MBTU
(2) Cost per MBTU	$ 2.44/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$ 20,911./YR.
(4) Differential Escalation Rate (7%) Factor	12.278
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$ 256,743.
b. Type of Fuel: #6 OIL	
(1) Annual Energy Decrease (+)/Increase (-)	19,407.MBTU
(2) Cost per MBTU	$ 8.91/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$ 172,916./YR.
(4) Differential Escalation Rate (8%) Factor	13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$2,267,280.
c. Type of Fuel: #2 OIL	
(1) Annual Energy Decrease (+)/Increase (-)	88,975.MBTU
(2) Cost per MBTU	$ 14.75/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$1,312,380./YR.
(4) Differential Escalation Rate (8%) Factor	13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$ 17,207,900.
d. Type of Fuel: LPG	
(1) Annual Energy Decrease (+)/Increase (-)	9,306.MBTU
(2) Cost per MBTU	$ 9.18/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$ 85,429./YR.
(4) Differential Esculation Rate (8%) Factor	13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4)	$1,120,150.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))	$ 20,852,100.
4. Total Benefits (Sum 2f + 3e)	$ 15,802,400.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)	2.3
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))	126,258.
7. E/C Ratio (Line 6 /Line 1a/1000)	19.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$ 958,838.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)	6.8

2.2.2 INCREMENT G RECOMMENDATIONS

1. COMPONENT	FY 1982 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		8 Jan 82

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Leonard Wood, Missouri	Install Flow Restrictors (MFH)

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
	71115		84

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Install Flow Restrictor Showerheads	Ea.	3028	25	76
Contingency (5%)				4
Total Contract Cost				80
Supervision, Inspection and Overhead (5%)				4
Total Request				84

10. DESCRIPTION OF PROPOSED CONSTRUCTION: Project involves replacement of existing free flow showerheads with one which restricts the flow to conserve energy through the reduction of hot water usage. Buildings involved include all family housing units on post.

B/C Ratio: 11.6, E/C Ratio: 333.6; Payback: 1.0 years; Savings: 28,024 MBTU, $80,870/year.

11. REQUIREMENT: This project is required in order to help meet the Army's stated goals for energy use reduction in existing facilities.

CURRENT SITUATION: The present installed shower heads are of the old free flowing variety. Since it is virtually impossible to control the amount of time people spend in the shower, energy savings must be realized by controlling the amount of hot water that flows during the process.

IMPACTIF NOT PROVIDED: If this project is not completed, energy consumption will continue at its present rate as costs rise and the supply diminishes.

This project has been reviewed and it has been determined that an EIS pursuant to PL 91-190 is not required.

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT LEONARD WOOD FY 1982
PROJECT: INSTALL FLOW RESTRICTORS - MFH
ECON. LIFE: 15 YRS. DATE: 1 / 8 / 82 PREPARED BY: JLC

COST		
1. Non-recurring Initial Capital Costs:		
a. Current Working Estimate	$	84,000.
b. Design	$	5,000.
c. Salvage	$	0.
d. Total	$	89,000.
BENEFITS		
2. Recurring Benefit/Cost Differential Other Than Energy:		
a. Annual Labor Decrease (+)/Increase (-)	$	0./YR.
b. Annual Material Decrease (+)/Increase (-)	$	0./YR.
c. Other Annual Decrease (+)/Increase (-)	$	0./YR.
d. Total Costs	$	0./YR.
e. 10% Discount Factor		0.000
f. Discounted Recurring Cost (d x e)	$	0.
3. Recurring Energy Benefit/Costs:		
a. Type of Fuel: PROPANE		
(1) Annual Energy Decrease (+)/Increase (-)		7,430.MBTU
(2) Cost per MBTU	$	6.20/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	46,066./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	604,017.
b. Type of Fuel:ELECTRICITY		
(1) Annual Energy Decrease (+)/Increase (-)		20,594.MBTU
(2) Cost per MBTU	$	1.69/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	34,804./YR.
(4) Differential Escalation Rate (7%) Factor		12.278
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	427,322.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))		$1,031,340.
4. Total Benefits (Sum 2f + 3e)		$1,031,340.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)		11.6
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))		28,024.
7. E/C Ratio (Line 6 /Line 1a/1000)		334.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$	80,870.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)		1.0

1. COMPONENT	FY 1982 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		November 81

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Leonard Wood, Missouri	Install Flow Restrictors-BACH. HSG

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
	721; 724		72

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Install Flow Restrictor Shower Heads	Ea.	2640	25.00	66
Contingency (5%)				3
Total Contract				69
Supervision, Inspection and Overhead				3
Total Request				72

10. DESCRIPTION OF PROPOSED CONSTRUCTION Project involves replacement of existing free flow shower heads with one which regulates the flow to conserve energy through the reduction of hot water usage. Buildings involved include all bachelor housing (BOQ and BEQ) facilities having showers.

B/C Ratio: 17.1; E/C Ratio: 266; Payback: .7 years; Energy Saved: 19,139 MBTU/year

11. REQUIREMENT: This project is required in order to help meet the Army's stated goals for energy use reduction in existing facilities.

CURRENT SITUATION: The present installed shower heads are of the old free flowing variety. Since it is virtually impossible to control the amount of time people spend in the shower, energy savings must be realized by controlling the amount of hot water that flows during the process.

IMPACT IF NOT PROVIDED: If this project is not completed energy consumption will continue at its present rate as costs rise and the supply diminishes.

This project has been reviewed and it has been determined that an EIS pursuant to PL 91-190 is not required.

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT LEONARD WOOD BACH. HSG FY 1982
PROJECT: INSTALL FLOW RESTRICTORS
ECON. LIFE: 15 YRS. DATE: 11 / 6 / 81 PREPARED BY: JLC & ASSOCIATES

COST		
1. Non-recurring Initial Capital Costs:		
a. Current Working Estimate	$	72,000.
b. Design	$	4,000.
c. Salvage	$	0.
d. Total	$	76,000.
BENEFITS		
2. Recurring Benefit/Cost Differential Other Than Energy:		
a. Annual Labor Decrease (+)/Increase (-)	$	0./YR.
b. Annual Material Decrease (+)/Increase (-)	$	0./YR.
c. Other Annual Decrease (+)/Increase (-)	$	0./YR.
d. Total Costs	$	0./YR.
e. 10% Discount Factor		0.000
f. Discounted Recurring Cost (d x e)	$	0.
3. Recurring Energy Benefit/Costs:		
a. Type of Fuel: NO.2 OIL		
(1) Annual Energy Decrease (+)/Increase (-)		5,055.MBTU
(2) Cost per MBTU	$	7.23/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	36,548./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	479,213.
b. Type of Fuel:NO.6 OIL		
(1) Annual Energy Decrease (+)/Increase (-)		14,084.MBTU
(2) Cost per MBTU	$	4.45/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	62,674./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	821,779.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))	$	1,300,990.
4. Total Benefits (Sum 2f + 3e)	$	1,300,990.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)		17.1
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))		19,139.
7. E/C Ratio (Line 6 /Line 1a/1000)		266.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$	99,221.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)		0.7

1. COMPONENT	FY 1982 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		15 Jan 82

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Leonard Wood, Missouri	Mechanical Alterations Various Facilities

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
			58

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Mechanical Alterations - Building 310	LS			19
Mechanical Alterations - Building 500	LS			5
Mechanical Alterations - Building 1608	LS			2
Mechanical Alterations - Building 1609	LS			26
Subtotal				52
Contingency (5%)				3
Total Contract				55
Supervision, Inspection and Overhead (5%)				3
Total Request				58

10. DESCRIPTION OF PROPOSED CONSTRUCTION: Work consists of installing enthalpy control economizer systems on Buildings 310, 1608, and 1609 reducing the minimum outside air in building 1608 and installing a variable air volume system in building 1609. Work involves modifications to existing systems to improve energy conservation capabilities.

B/C: 2.7; E/C: 104; Payback: 4.5 years; Savings: 6031 MBTU, $13033/year.

11. REQUIREMENT: This project is required to help meet the Army's stated goals for energy use reduction in existing facilities.

CURRENT SITUATION: The present mechanical systems in these facilities are not operating as efficiently as it is possible for them to with a few minor alterations. Buildings 310, 1608, and 1609 do not have the capability to use 100% outside air for cooling when conditions are favorable. Building 1608 brings in more outside air than necessary when in the heating or cooling mode. Building 1609 presently operates with a constant volume regardless of the load which has large fluctuation.

IMPACT IF NOT PROVIDED: If this project is not completed, energy waste will continue at the present rate as costs rise and the supply diminishes.

This project has been reviewed and it has been determined that an EIS pursuant to PL 91-190 is not required.

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT LEONARD WOOD FY 1982
PROJECT: MECHANICAL ALTERATIONS - VARIOUS FACILITIES
ECON. LIFE: 15 YRS. DATE: 1 / 15 / 82 PREPARED BY: JLC
COST

1. Non-recurring Initial Capital Costs:		
a. Current Working Estimate	$	58,000.
b. Design	$	3,300.
c. Salvage	$	0.
d. Total	$	61,300.
BENEFITS		
2. Recurring Benefit/Cost Differential Other Than Energy:		
a. Annual Labor Decrease (+)/Increase (-)	$	0./YR.
b. Annual Material Decrease (+)/Increase (-)	$	0./YR.
c. Other Annual Decrease (+)/Increase (-)	$	0./YR.
d. Total Costs	$	0./YR.
e. 10% Discount Factor		0.000
f. Discounted Recurring Cost (d x e)	$	0.
3. Recurring Energy Benefit/Costs:		
a. Type of Fuel: ELECTRICITY		
(1) Annual Energy Decrease (+)/Increase (-)		5,649.MBTU
(2) Cost per MBTU	$	1.69/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	9,547./YR.
(4) Differential Escalation Rate (7%) Factor		12.278
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	117,216.
b. Type of Fuel:NO.2 OIL		
(1) Annual Energy Decrease (+)/Increase (-)		302.MBTU
(2) Cost per MBTU	$	9.95/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	3,005./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	39,400.
c. Type of Fuel: NO.6 OIL		
(1) Annual Energy Decrease (+)/Increase (-)		80.MBTU
(2) Cost per MBTU	$	6.01/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	481./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	6,304.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))	$	162,920.
4. Total Benefits (Sum 2f + 3e)	$	162,920.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)		2.7
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))		6,031.
7. E/C Ratio (Line 6 /Line 1a/1000)		104.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$	13,033.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)		4.5

1. COMPONENT	FY 1982 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		15 Jan 82

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Leonard Wood, Missouri	Add HWH Insulation (MFH)

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
			75

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Install 1-1/2" Fiberglass Blanket	EA	2728	25	68
Contingency (5%)				3
Total Contract Cost				71
Supervision, Inspection & Overhead (5%)				4
Total Request				75

10. DESCRIPTION OF PROPOSED CONSTRUCTION: Work involves installing a 1-1/2 inch fiberglass blanket over 1427 LPG and 1301 electric hot water heaters in all of family housing.

B/C: 3.6; E/C: 99; Payback: 3.4; Savings: 7395 MBTU, $22,086/year.

11. REQUIREMENT: This project is required to help meet the Army's stated goals for energy use reduction in existing facilities.

CURRENT SITUATION: The hot water heaters (HWH) in the quarters have only that minimum insulation furnished by the manufacturer.

IMPACT IF NOT PROVIDED: If this project is not completed, energy waste will continue at the present rate as costs rise and the supply diminishes.

This project has been reviewed and it has been determined that an EIS pursuant to PL 91-190 is not required.

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT LEONARD WOOD MFH FY 1982
PROJECT: INSTALL HW HEATERS (MFH)
ECON. LIFE: 15 YRS. DATE: 1 / 15 / 82 PREPARED BY: JLC

COST		
1. Non-recurring Initial Capital Costs:		
a. Current Working Estimate	$	75,000.
b. Design	$	4,300.
c. Salvage	$	0.
d. Total	$	79,300.
BENEFITS		
2. Recurring Benefit/Cost Differential Other Than Energy:		
a. Annual Labor Decrease (+)/Increase (-)	$	0./YR.
b. Annual Material Decrease (+)/Increase (-)	$	0./YR.
c. Other Annual Decrease (+)/Increase (-)	$	0./YR.
d. Total Costs	$	0./YR.
e. 10% Discount Factor		0.000
f. Discounted Recurring Cost (d x e)	$	0.
3. Recurring Energy Benefit/Costs:		
a. Type of Fuel: ELECTRICITY		
(1) Annual Energy Decrease (+)/Increase (-)		5,269.MBTU
(2) Cost per MBTU	$	1.69/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	8,905./YR.
(4) Differential Escalation Rate (7%) Factor		12.278
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	109,331.
b. Type of Fuel:PROPANE		
(1) Annual Energy Decrease (+)/Increase (-)		2,126.MBTU
(2) Cost per MBTU	$	6.20/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	13,181./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	172,832.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))	$	282,163.
4. Total Benefits (Sum 2f + 3e)	$	282,163.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)		3.6
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))		7,395.
7. E/C Ratio (Line 6 /Line 1a/1000)		99.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$	22,086.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)		3.4

1. COMPONENT	FY 1982 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		3 DEC 81

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
FORT LEONARD WOOD, MISSOURI	INSTALL HEAT RECLAIM SYSTEM

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
	74021		40

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Install Heat Reclaim System	JOB	1	36,000	36
Contingency (5%)				2
Total Contract Cost				38
Supervision, Inspection and Overhead (5%)				2
Total Request				40

10. DESCRIPTION OF PROPOSED CONSTRUCTION

Work consists of installing a heat reclaim system on the existing refrigeration equipment in the Commissary, BLDG. 498. Installation is to furnish heat to the entire Commissary in lieu of the existing boiler.

B/C Ratio: 4.4; E/C Ratio: 36; Energy Saved: 1434 MBTU/yr; Payback: 2.8 yrs.

11. REQUIREMENT: This project is required in order to help meet the Army's stated goals for energy use reduction in existing facilities.

CURRENT SITUATION: At the percent, the heat guaranteed by the commissary refrigeration equipment is being rejected into the atmosphere down the sewer. At the same time, a boiler is fired with #2 oil to provide heat for the sales, offices and storage areas. The heat being rejected exceeds the building heating load, and enough is reclaimable to heat the building without the use of #2 fuel.

IMPACT IF NOT PROVIDED: If this project is not completed energy consumption will continue at its present rate as costs rise and the supply diminishes.

This project has been reviewed and it has been determined that an EIS pursuant to PL 91-190 is not required.

ECIP ECONOMIC ANALYSIS SUMMARY

LOCATION: FORT LEONARD WOOD BLDG. 498 FY 1982
PROJECT: INSTALL HEAT RECLAIM SYSTEM IN COMMISSARY
ECON. LIFE: 15 YRS. DATE: 12 / 3 / 81 PREPARED BY: JLC & ASSOCIATES

COST		
1. Non-recurring Initial Capital Costs:		
a. Current Working Estimate	$	40,000.
b. Design	$	2,400.
c. Salvage	$	0.
d. Total	$	42,400.
BENEFITS		
2. Recurring Benefit/Cost Differential Other Than Energy:		
a. Annual Labor Decrease (+)/Increase (-)	$	0./YR.
b. Annual Material Decrease (+)/Increase (-)	$	0./YR.
c. Other Annual Decrease (+)/Increase (-)	$	0./YR.
d. Total Costs	$	0./YR.
e. 10% Discount Factor		0.000
f. Discounted Recurring Cost (d x e)	$	0.
3. Recurring Energy Benefit/Costs:		
a. Type of Fuel: NO.2 OIL		
(1) Annual Energy Decrease (+)/Increase (-)		1,434.MBTU
(2) Cost per MBTU	$	9.95/MBTU
(3) Annual Dollar Decrease/Increase ((1)x(2))	$	14,268./YR.
(4) Differential Escalation Rate (8%) Factor		13.112
(5) Discounted Dollar Decrease/Increase ((3)x(4))	$	187,086.
e. Discounted Energy Benefits (3a(5)+3b(5)+3c(5)+3d(5))	$	187,086.
4. Total Benefits (Sum 2f + 3e)	$	187,086.
5. Discounted Benefit/Cost Ratio (Line 4/Line 1d)		4.4
6. Total Annual Energy Savings (3a(1)+3b(1)+3c(1)+3d(1))		1,434.
7. E/C Ratio (Line 6 /Line 1a/1000)		36.
8. Annual $ Savings (2d + 3a(3)+3b(3)+3c(3)+3d(3))	$	14,268.
9. Pay-back Period ((Line 1a - Salvage)/Line 8)		2.8

3.0 CURRENT AND FUTURE ENERGY USAGE SUMMARY

3.0 Current and Future Energy Usage Summary

This section presents the historical basewide energy consumption (FY75-81) according to fuel type and electricity. In addition, historical energy consumption and future goals are presented in tabular and graphic form (pp 3-3 through 3-8). The intent of these tables and graphs is to depict past consumption trends and to predict future consumption with regard to FY85 goals. As the graphs illustrate of pp 3-7 and 3-8, FLW will not reach their FY85 goal through the implementation of proposed ECIP. As stated in Section 1.0 of this Executive Summary, the recent increases in electrical consumption, and problems encountered with previous ECIP, maintenance, repair and energy management have contributed to the increase in basewide consumption above that of the FY75 base year.

Monthly tables and graphs on historical energy consumption appear in Volume 1, Section 3; OMA and MFH consumption are presented independently, as well as electric KW demand and electrical consumption (KWH).

In addition, individual building energy consumption (utilizing FY75 as the base year) is calculated for existing typical facilities in Section 2.0, Volume 2, Appendix 1 (building lists). New construction energy consumption projections are presented in Section 3.0 of the above referenced volume. These individual building consumption charts depict high energy consumers and provide load profiles for each typical facility.

3.1 TOTAL MBTU'S FORT LEONARD WOOD (MFH & OMA)

	FY 75	FY 76	FY 77	FY 78	FY 79	FY 80	FY 81
#1 Oil							
1st Qtr.	14413.	11742.5	16749.	17242.1	11100.	8898.2	8846.9
2nd Qtr.	19465.	17708.5	24570.5	24697.8	21423.	14111.9	12333.3
3rd Qtr.	2163.	4031.1	2594.3	2235.	1960.	2167.9	1924.
4th Qtr.	967.	1359.9	508.5	962.	375.	401.5	954.
	37008.	34842.	44422.3	45136.9	34858.	25579.5	24058.2
#2 Oil							
1st Qtr.	196572.8	160496.4	237701.7	183688.1	175509.	147510.9	142015.6
2nd Qtr.	313538.	265296.5	305751.8	348880.2	330400.	254296.6	207954.4
3rd Qtr.	73159.	90717.	57742.7	66307.	91770.	44178.6	32764.
4th Qtr.	17869.	31531.5	16339.2	37887.	12321.	11232.	38902.
	601138.8	548041.4	617535.4	636762.3	610000.	457218.1	421636.
#6 Oil							
1st Qtr.	140318.8	129084.4	151913.4	148337.4	127989.	156394.6	175140.2
2nd Qtr.	177198.	167082.8	183452.7	210456.7	229669.	231986.4	206840.9
3rd Qtr.	89816.	93628.1	89658.2	91595.	112245.	115733.3	111607.
4th Qtr.	62906.	63091.2	65486.3	63135.	83992.	77962.4	85729.
	470238.8	452886.5	490510.6	513524.1	553895.	582076.7	579317.1
LPG							
1st Qtr.	122810.8	102614.	132534.8	108456.6*	99810.5	91341.5*	79999.8
2nd Qtr.	202039.	165717.	191171.7	190636.2	164955.7	139098.	133312.9
3rd Qtr.	78226.	72001.7	55075.6	54828.5	49589.5	42651.1	41673.
4th Qtr.	43338.	30940.1	35046.3	34046.7	31223.1	26273.1	24567.
	446413.8	371272.8	413828.4	387968.0	345578.8	299363.9	279522.7
Electric							
1st Qtr.	266800.	275337.6	298955.2	297099.2	303224.	290556.8	296124.8
2nd Qtr.	282206.	289907.2	313988.8	308049.6	330228.8	314684.8	312457.6
3rd Qtr.	283133.	281555.2	313339.2	303930.4	296913.6	298251.1	326563.
4th Qtr.	358905.	371153.6	408830.4	426694.4	364890.6	466789.7	450220.
	1191044.	1217953.	1335113.6	1335773.6	1295257.0	1370282.4	1385665.4

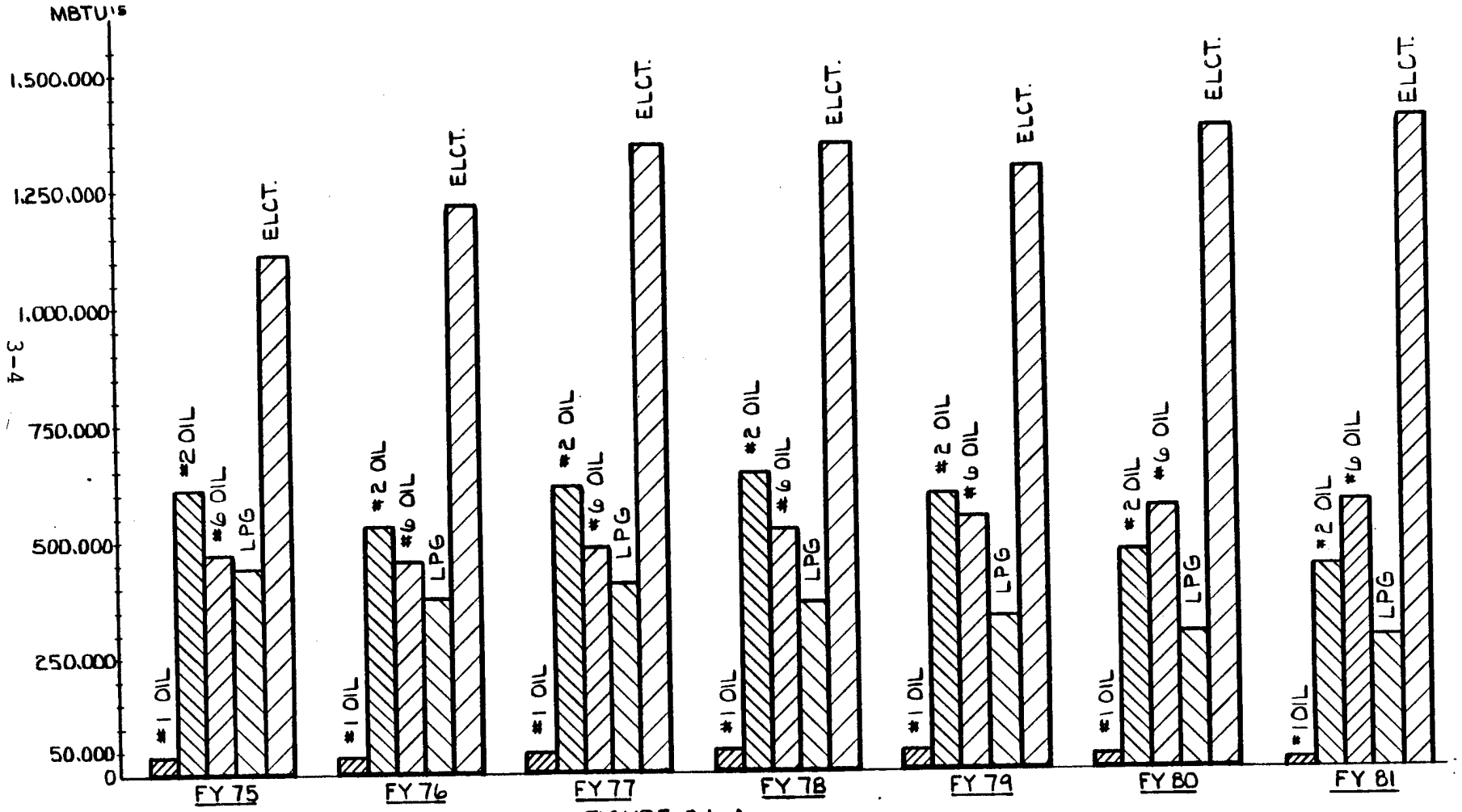

FIGURE 3.1-A

TOTAL ENERGY CONSUMPTION – FORT LEONARD WOOD

3.2 FORT LEONARD WOOD ENERGY CONSUMPTION SUMMARY

Parameter	Unit	FY 75	FY 76	FY 77	FY 78	FY 79	FY 80	FY 81
*Area	Sq. Ft.	12,120,000	12,134,791	12,068,860	12,257,291	12,474,143	12,474,128	12,474,128
Source Energy Consumed	MBTU/Yr	2,745,843	2,624,996.3	2,901,410.3	2,919,164.8	2,839,588.8	2,734,519.7	2,790,416.2
*Energy Cost	Dollars/Yr	$ 4,755,064	$ 5,247,462	$ 5,853,606	6,521,364	$ 6,635,411.80	$ 10,722,142.41	$ 12,048,240.61
Source Energy/Area/Year	MBTU/KSF/Yr	226.555	216.320	240.405	238.157	227.638	219.215	223.696
*TRADOC Goal	MBTU/KSF/Yr	226.632	238.197	249.762	238.555	227.347	222.200	205.899
Energy Cost/Area/Year	Dollars/KSF/Yr	$ 392.33	$ 392.33	$ 485.02	$ 532.04	$ 531.93	$ 859.55	1035.35
Source INdex	Ref. FY 75	100	96	106	106	103	99	102
Cost Index	Ref. FY 75	100	110	123	137	140	225	253
Fuels Consumed	MBTU/Yr	$ 1,554,799.4	1,407,042.7	1,566,296.7	1,583,391.2	1,544,331.8	1,364,238.1	1,308,726.8
Fuels Cost	Dollars/Yr	$ 3,586,357	$ 3,333,801	$ 3,958,530	$ 4,256,950	4,086,185.8	8,089,863.97	$ 8,888,216.57
Fuels Energy/Area/Year	MBTU/KSF/Yr	128.284	115.951	129.780	129.180	123.803	109.365	104.915
Fuels Cost/Area/Year	Dollars/KSF/Yr	$ 295.90	$ 274.73	$ 327.99	$ 347.30	$ 327.57	$ 648.53	$ 712.53
Fuels Index	Ref. FY 75	100	91	101	102	99	88	82
Fuels Cost Index	Ref. FY 75	100	93	110	119	114	226	240
Heating Degree Days	———	4740	4040	5040	5410	5373	4530	4231
Heating Fuels Index	MBTU/KSF/DD/Yr	.0271	.0287	.0258	.0239	.0231	.0242	.0248
Electricity Consumed	KWH/Yr	102,196,000	135,935,000	115,096,000	115,696,000	111,660,000	118,964,000	119,428,000
Source Electricity Energy	MBTU/Yr	1,191,044	1,217,953.6	1,335,113.6	1,335,773.6	1,295,257	1,370,281.6	1,385,364.8
Electricity Cost	Dollars/Yr	$ 1,168,707	$ 1,913,661	$ 1,896,076	$ 2,264,414	$ 2,549,226	$ 2,632,278.44	$ 3,160,024.04
Electricity KWH/Area/Year	KWH/SF/Yr	8.432	11.202	9.537	9.439	8.951	9.537	9.574
Electricity Energy/Area/Year	MBTU/KSF/Yr	98.271	100.369	110.625	108.978	103.835	109.850	111.059
Electricity Cost/Area/Year	Dollars/KSF/Yr	$ 96.43	$ 157.70	$ 157.11	$ 184.74	$ 204.36	$ 211.02	$ 253.33
Electricity Index	Ref. FY 75	100	102	112	112	109	115	117
Electricity Cost Index	Ref. FY 75	100	163	162	194	218	225	263
Electrical Demand	Peak KW	21,600	22,800	23,600	24,000	24,600	27,000	28,400

3.2.1 FLW HISTORICAL ENERGY CONSUMPTION AND FUTURE GOALS

(MBTU/YR AND ADJUSTED FOR DEGREE DAY)

	FY 75	FY 76	FY 77	FY 78	FY 79	FY 80	FY 81	FY 82	FY 83	FY 84	FY 85
MBTU/YR	2,745,843	2,624,996	2,901,410	2,919,165	2,839,589	2,734,520	2,790,416	2,444,975	2,309,074	2,286,631	2,264,189
D.D./YR	6051	5149	6746	6968	6462	6456	5682	5952	5952	5952	5952
MBTU/D.D./YR	453.78	509.81	430.09	418.94	439.43	423.56	491.10	410.78	387.95	384.18	380.41

3.2.2 FLW HISTORICAL ENERGY CONSUMPTION AND FUTURE GOALS

(MBTU/YR AND BTU/SQ.FT./DEGREE DAY)

	FY 75	FY 76	FY 77	FY 78	FY 79	FY 80	FY 81	FY 82	FY 83	FY 84	FY 85
MBTU/YR	2,745,843	2,624,996	2,901,410	2,919,165	2,839,589	2,734,520	2,790,416				
SQ. FT.	12,120,000	12,134,791	12,068,860	12,257,291	12,474,143	12,474,128					
MBTU/SQ.FT.	.2266	.2163	.2404	.2382	.2276	.2192	.2237	.1961	.1854	.1834	.1816
D.D./YR	6051	5149	6746	6968	6462	6456	5682	5952	5952	5952	5952
BTU/SQ.FT./D.D.	37.45	42.01	35.64	34.18	35.22	33.95	39.37	32.95	31.15	30.81	30.51

Goals are based on TRADOC guidelines (27 Feb 80).

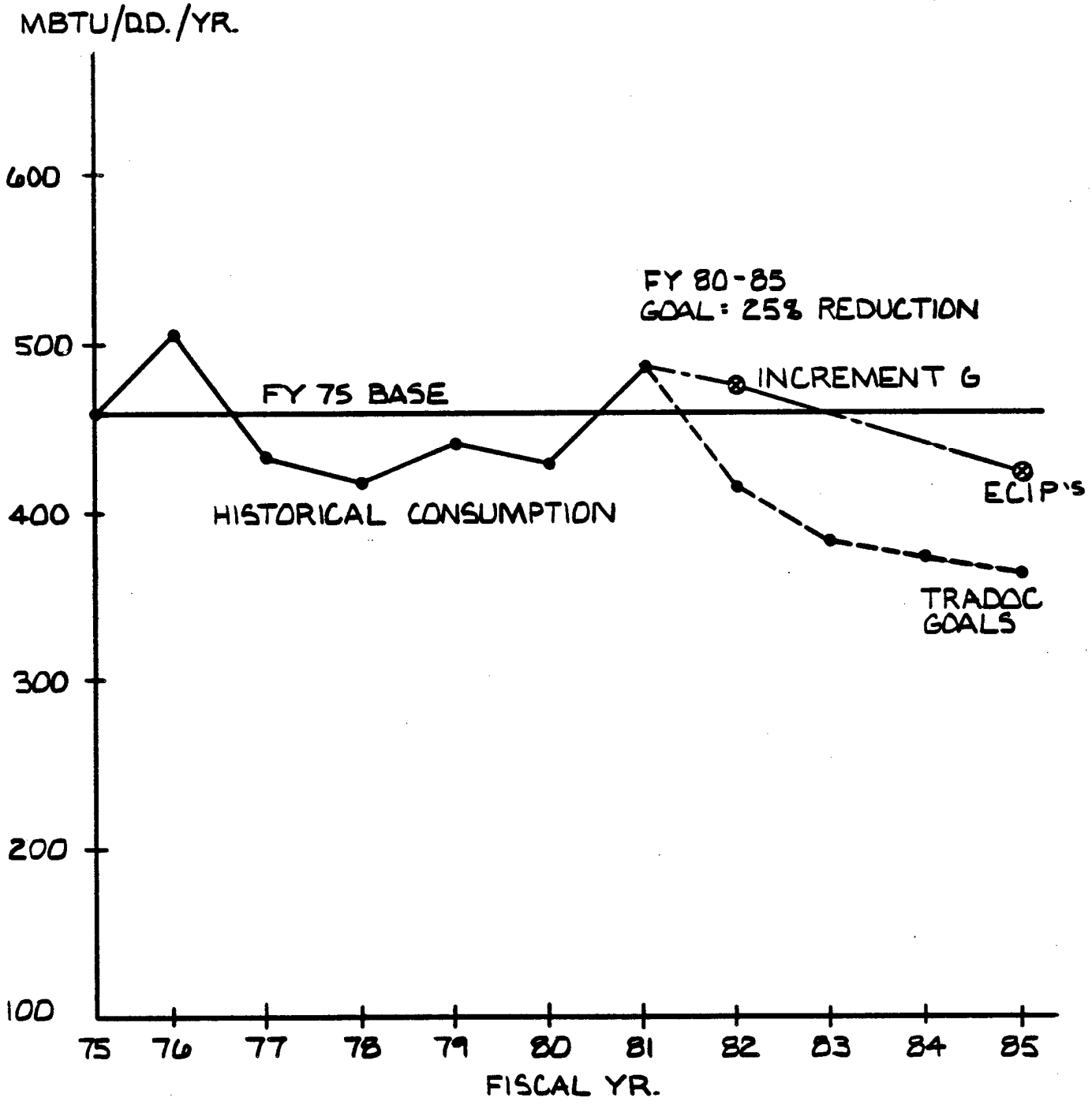

FIGURE 3.2.1-A
FLW HISTORICAL ENERGY CONSUMPTION
AND FUTURE GOALS

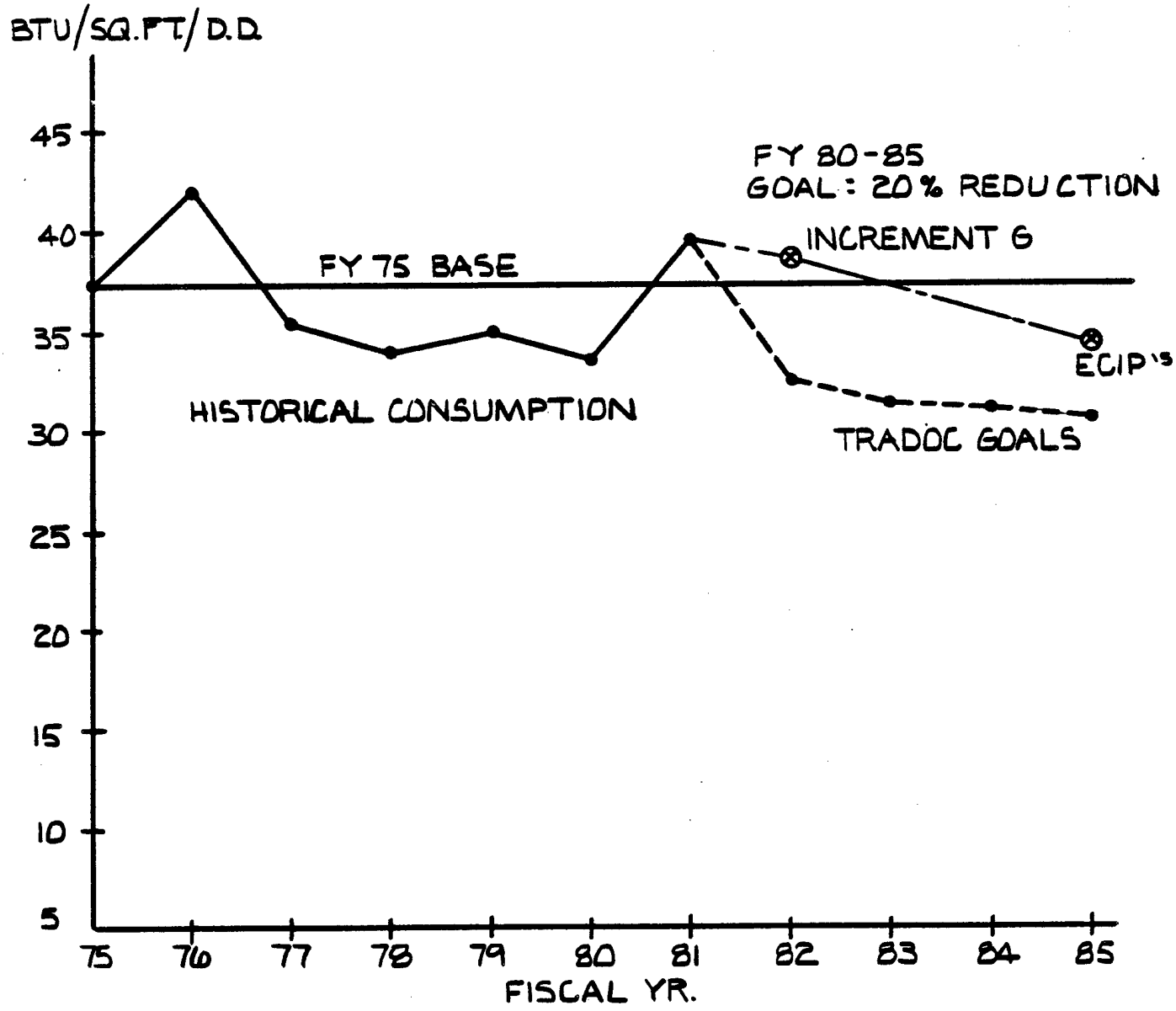

FIGURE 3.2.2-A
FLW HISTORICAL ENERGY CONSUMPTION
AND FUTURE GOALS